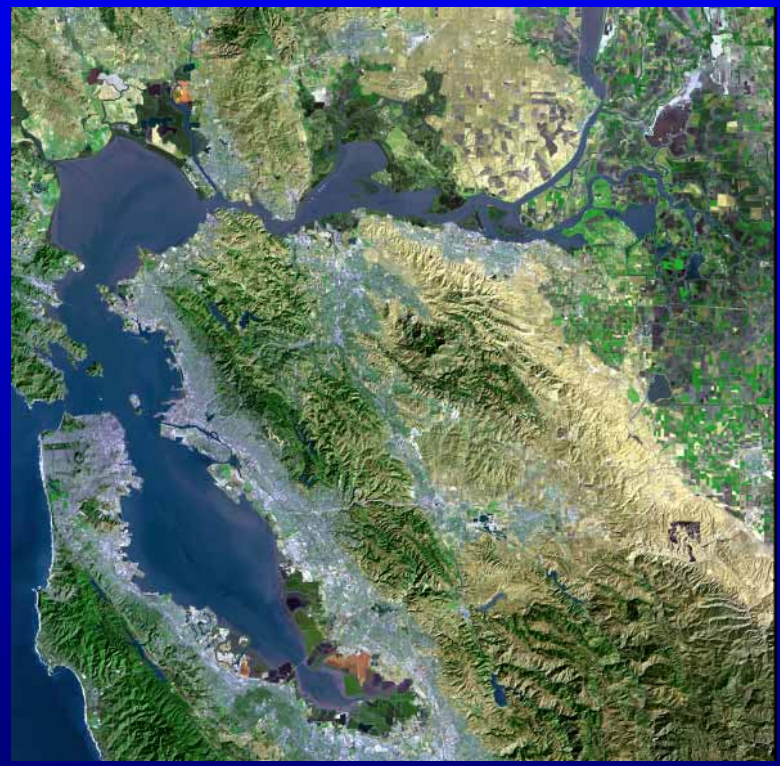
FTDCCTDF Meeting July 27, 2006

TDF/DCC Re-operation
Particle Tracking

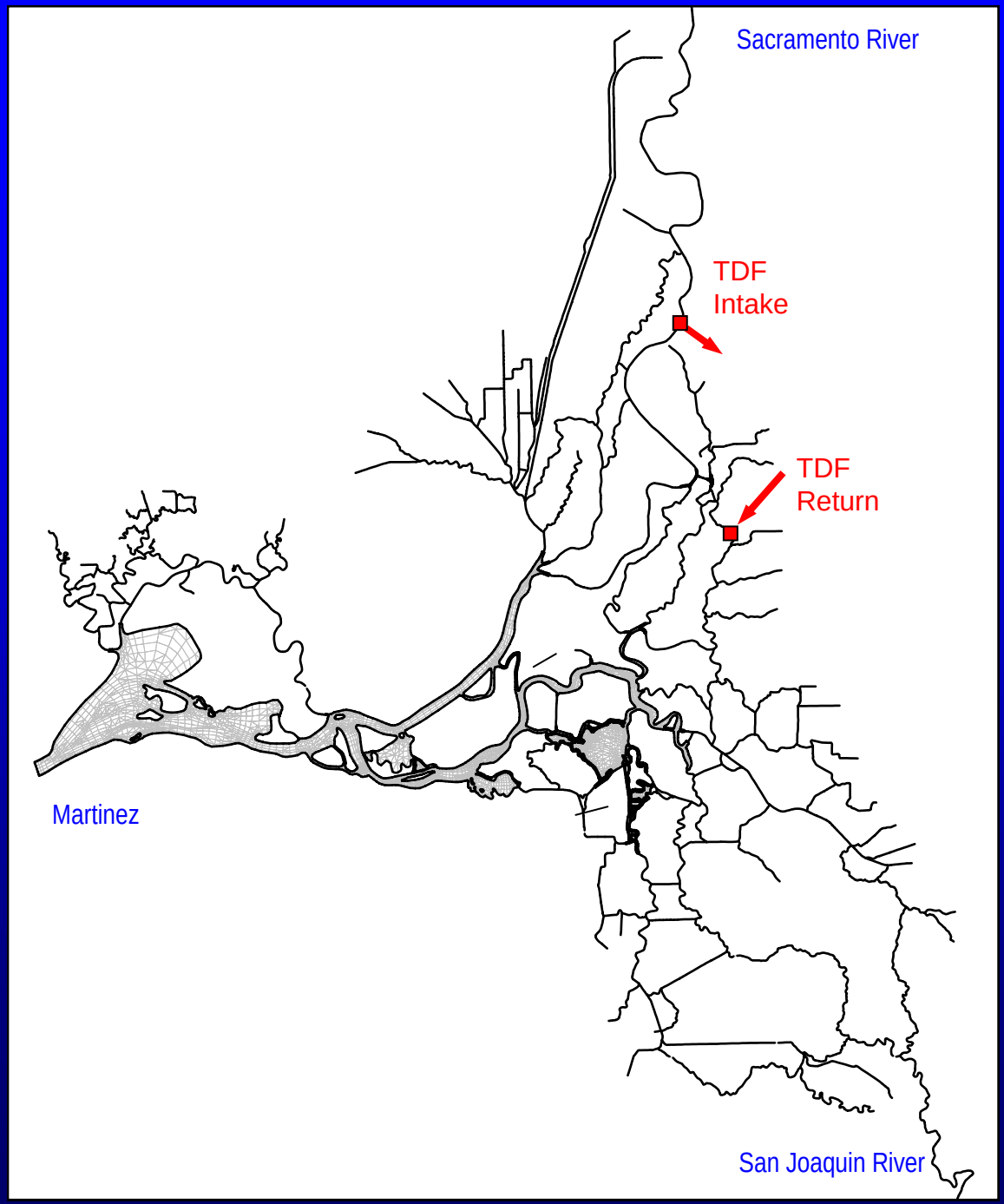


Resource Management Associates
John DeGeorge
Richard Rachiele
Stacie Grinbergs

Initial TDF/DCC Re-operation Modeling

- Examine “bookend” TDF/DCC operations to guide future simulations.
  - TDF constant 4000 cfs
  - Alt 1: DCC with historical operations
  - Alt 2: DCC always closed

- TDF Model Configuration
  - Transfer from Sacramento River near Courtland to S. Fork of the Mokelumne River.



TDF Configuration for Model

4000 cfs withdrawal at "TDF Intake".

4000 cfs inflow at "TDF Return".

EC of TDF return flow assumed to be equal to the Sacramento River upstream boundary condition EC.

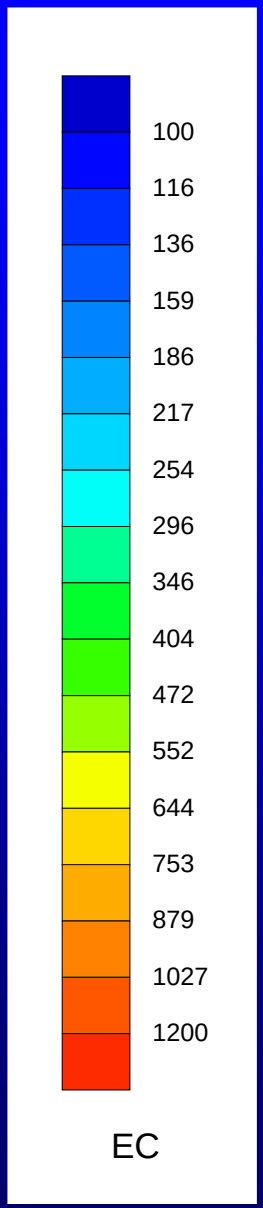
Initial TDF/DCC Re-operation Modeling

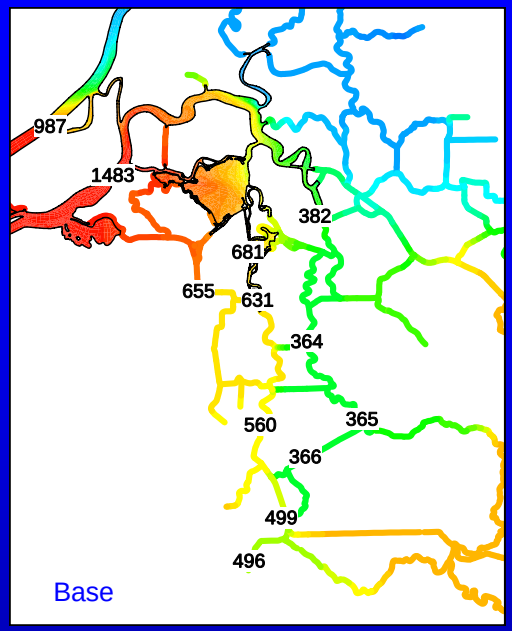
- Analysis Years: 1991 to 1992, 2000 and 2002
- Compare results with
  - Base historical conditions, No Project
  - FIPP Alternative 1: West False River Constriction. (Simple constriction in west False River)
- Also performed a combined TDF with FIPP simulation
  - DCC with historical operation
  - Year 2002 only.

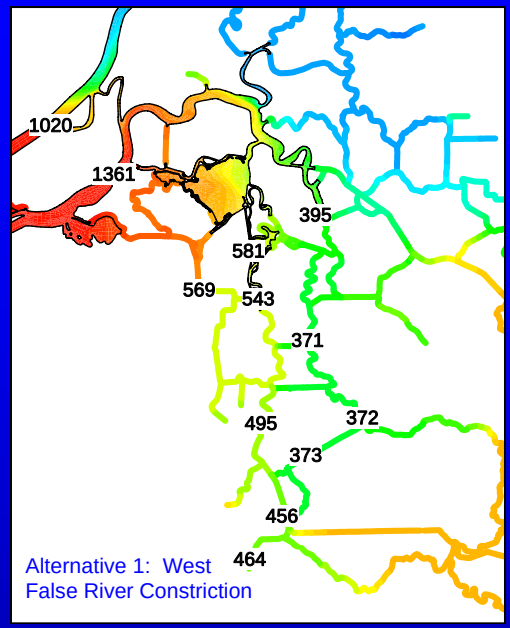
Results Summary

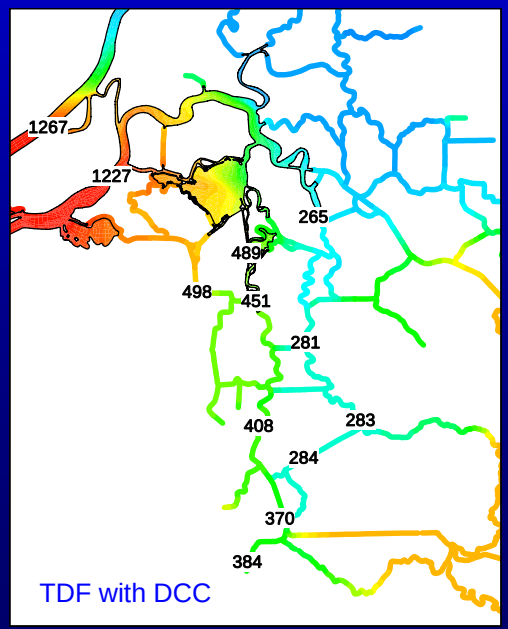
- The TDF with historical DCC operation provided more than twice the salinity reduction at the SWP and CVP vs. the FI Pilot Project Alternative 1
- The salinity reduction at the export locations for the TDF No DCC (DCC always closed) vs. the Base condition varied.
  - Where Base condition DCC flow < 4000 cfs, then EC reduction.
  - Where Base condition DCC flow > 4000 cfs, then EC increased.
- TDF raises EC for the Sacramento River at Emmaton and Rio Vista . Important in Critically Dry years.
- The FI Pilot Project Alternative 1 provided additional salinity reduction to the TDF (Simulated 2002 only).
- EC changes result from TDF changes to Delta flow regime.

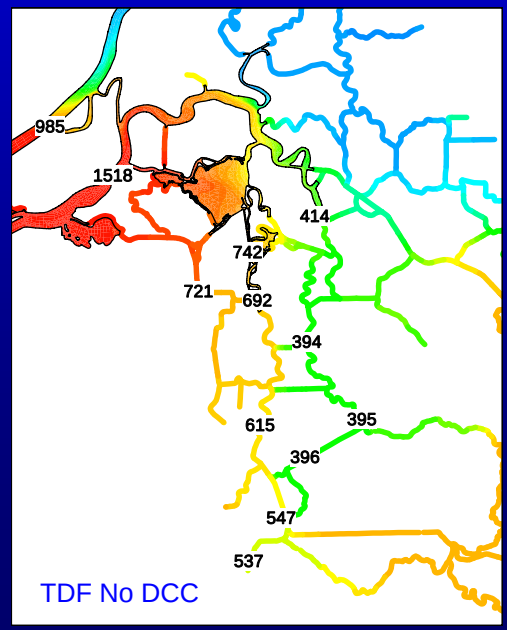
EC Comparisons September 1, 2002











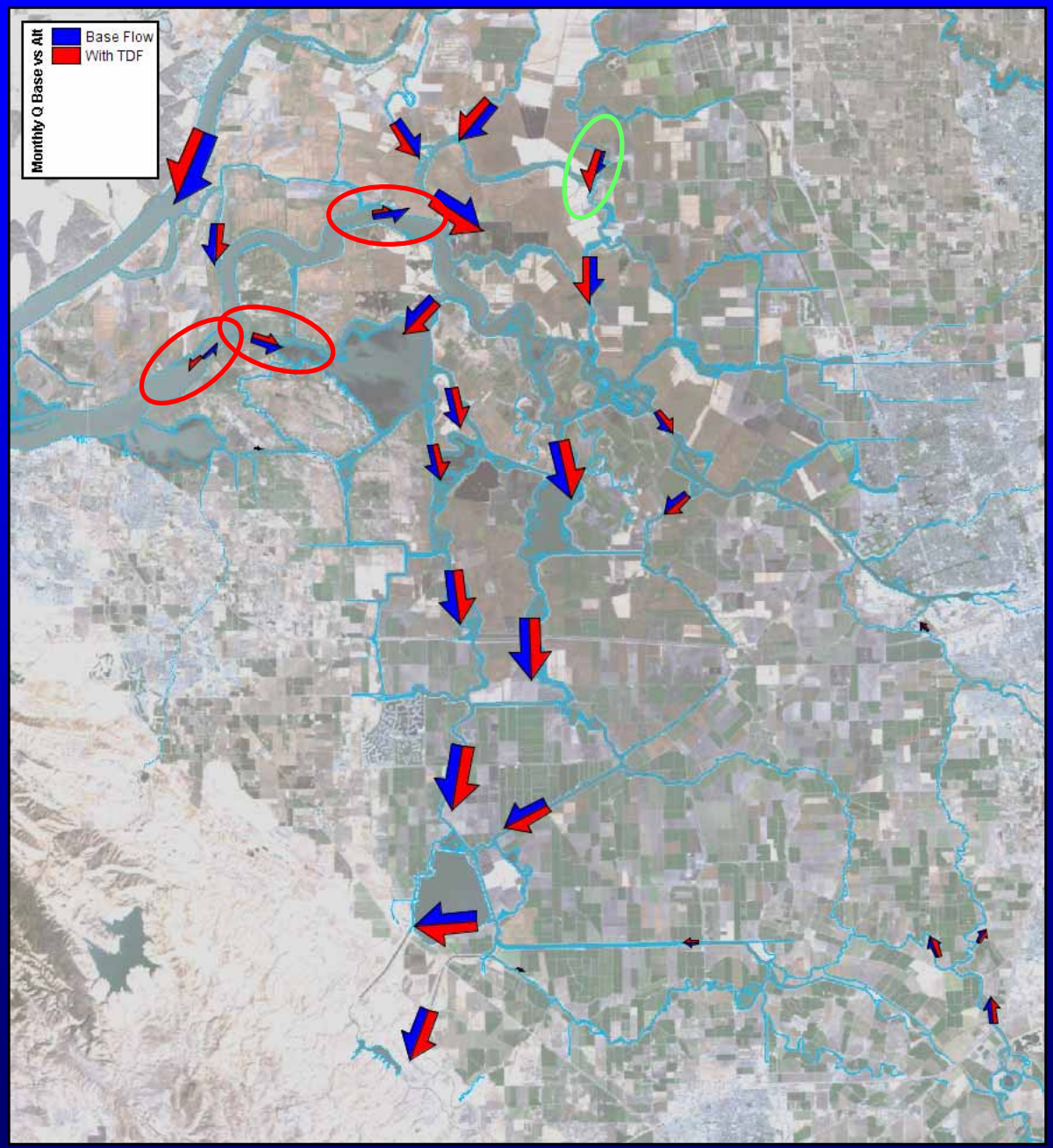
Delta Flow Changes with Initial TDF/DCC Alternatives

- Not much change to Delta flows south of Franks Tract
- TDF with DCC
  - More flow down South Fork Mokelumne River.
  - More net flow outward on San Joaquin River, less salinity intrusion into central Delta.
  - Less net flow outward on Sacramento River, higher salinity there.
- TDF No DCC
  - Depends upon Base condition DCC flow.

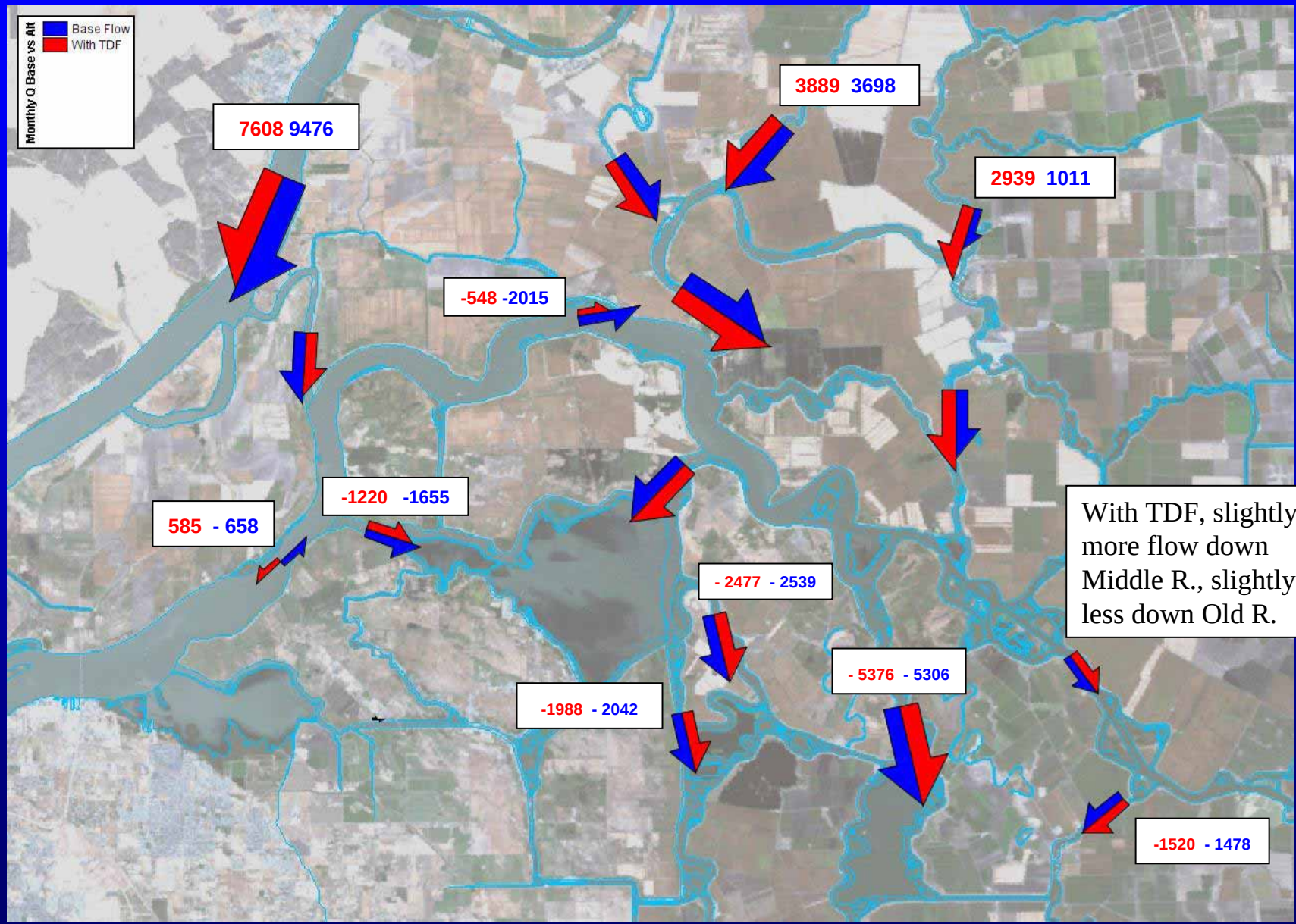
Net Monthly Flows for July 2002

TDF with DCC vs. Base

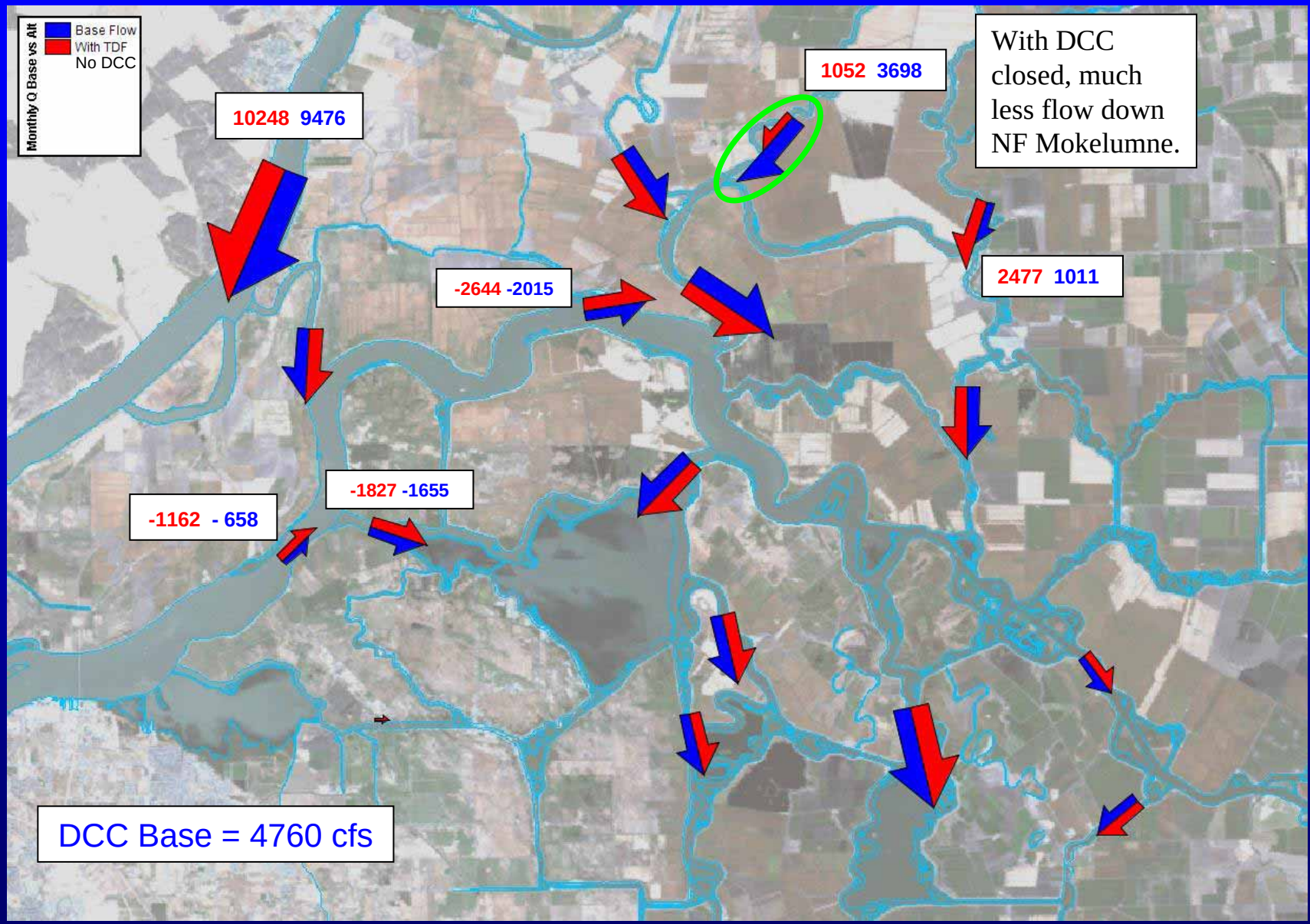
- More flow down SF Mokelumne River.
- Once south of Franks Tract, not much difference in Base vs. TDF net flows
- TDF Reduces salinity intrusion on the SJR and into Franks Tract.



Net Monthly Flows for July 2002 TDF with DCC vs. Base



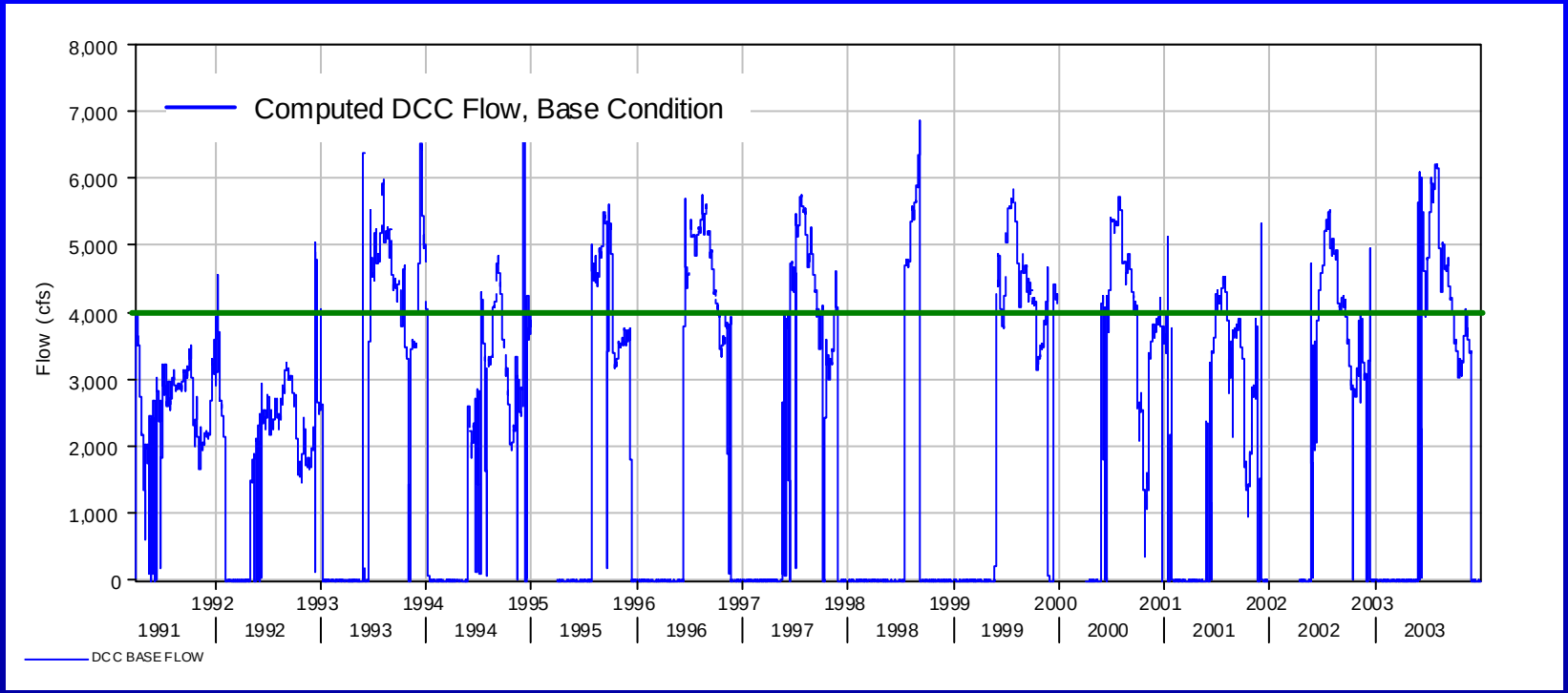
Net Monthly Flows for July 2002 TDF No DCC vs. Base



Changes to Delta Flow, TDF No DCC

- Assume salinity reduction vs. Base condition if TDF flow > Base condition DCC flow.
- Base condition DCC flow related to Sacramento River Flow
- Base condition DCC flow < 4000 cfs
  - In Critically Dry years and fall months of most years.
  - Months when DCC historically closed.
- Base condition DCC flow > 4000 cfs
  - Summer months of most years.

Delta Cross Channel Flow
(Base Condition Model Result)

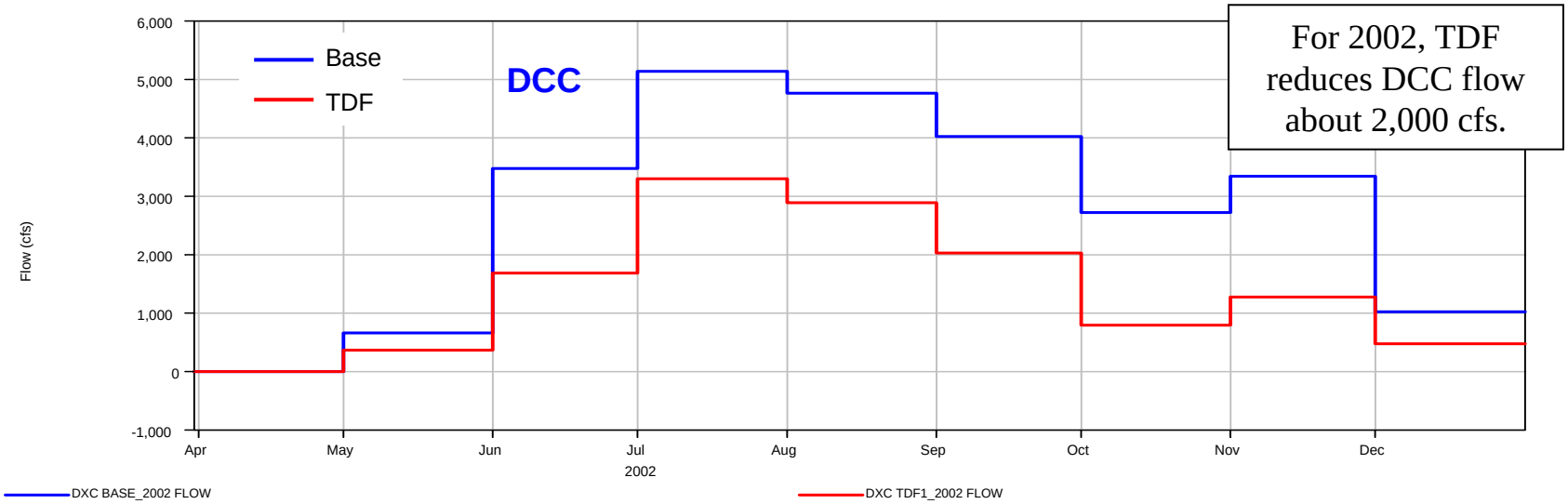


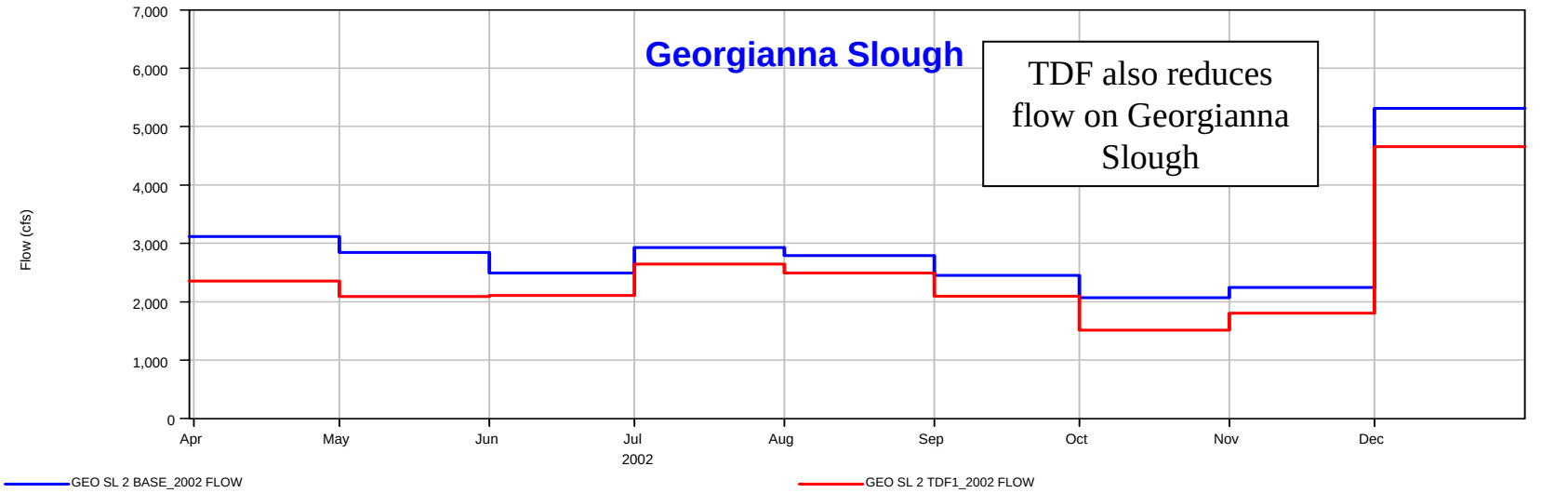
Base condition DCC < 4000 cfs in critically dry years and in fall months of other years.

DCC Flow with the TDF Operation

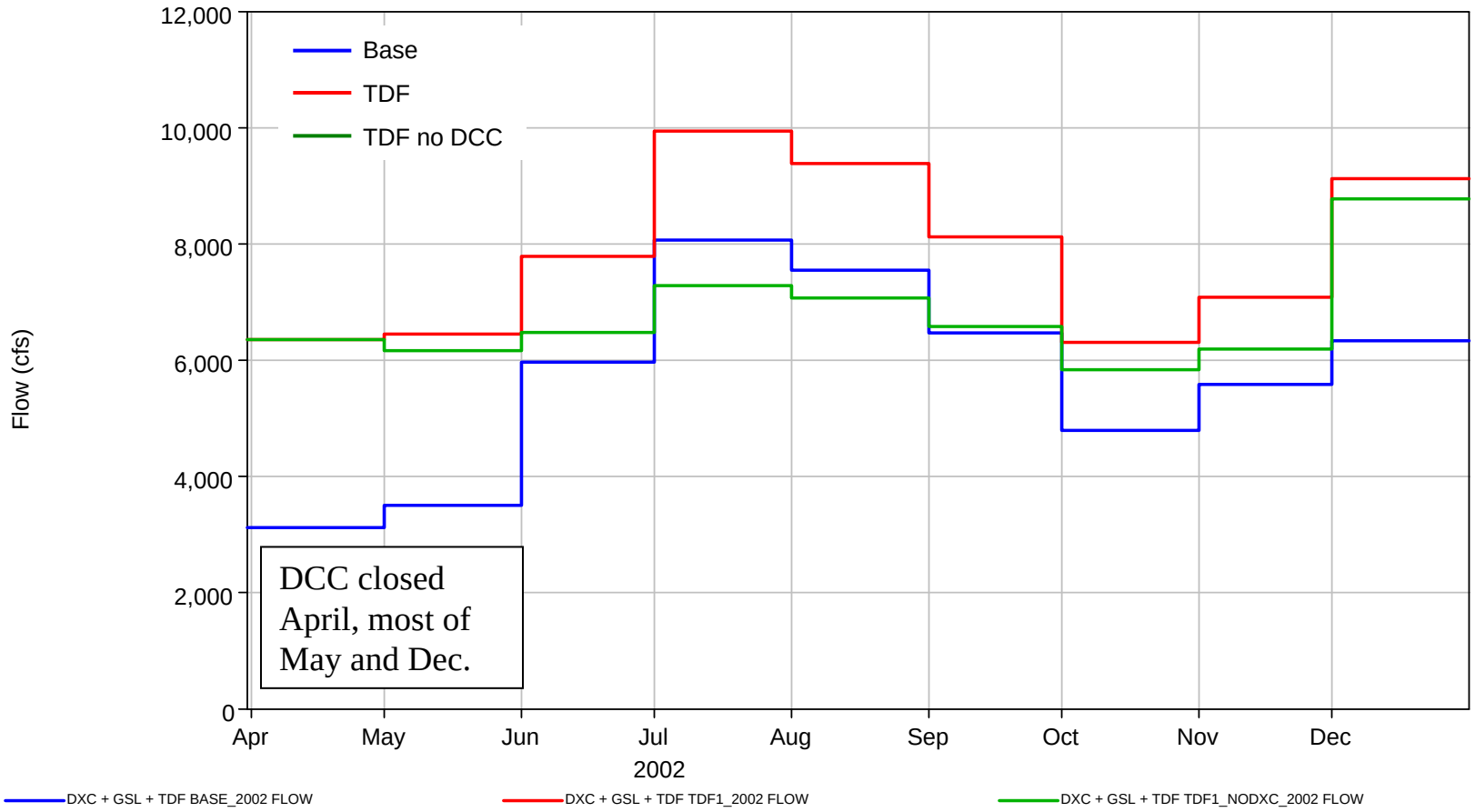
- Flow transfer from Sacramento River to the Mokelumne River system not the simple sum of the individual TDF and the DCC flows.
  - For the year 2002, the TDF operation reduces the DCC flow by about 2000 cfs.
  - The TDF operation also reduces the flow on Georgianna Slough
  - Must compare combined flow of TDF, DCC and Georgianna Slough

Monthly Average DCC and Geogianna Sl Flow TDF vs. Base for 2002

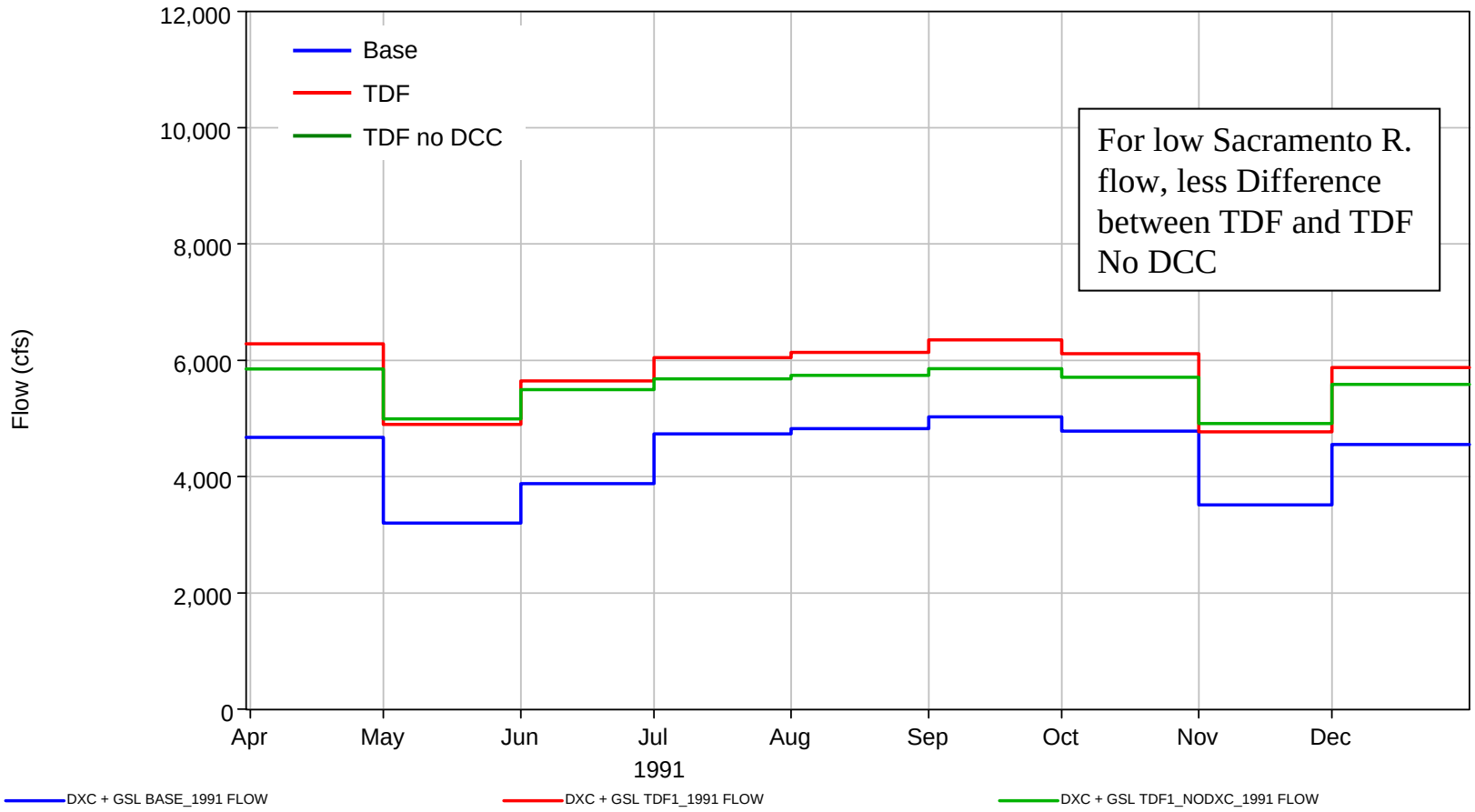




2002 Monthly Average Flow, DCC + Geogianna Sl + TDF



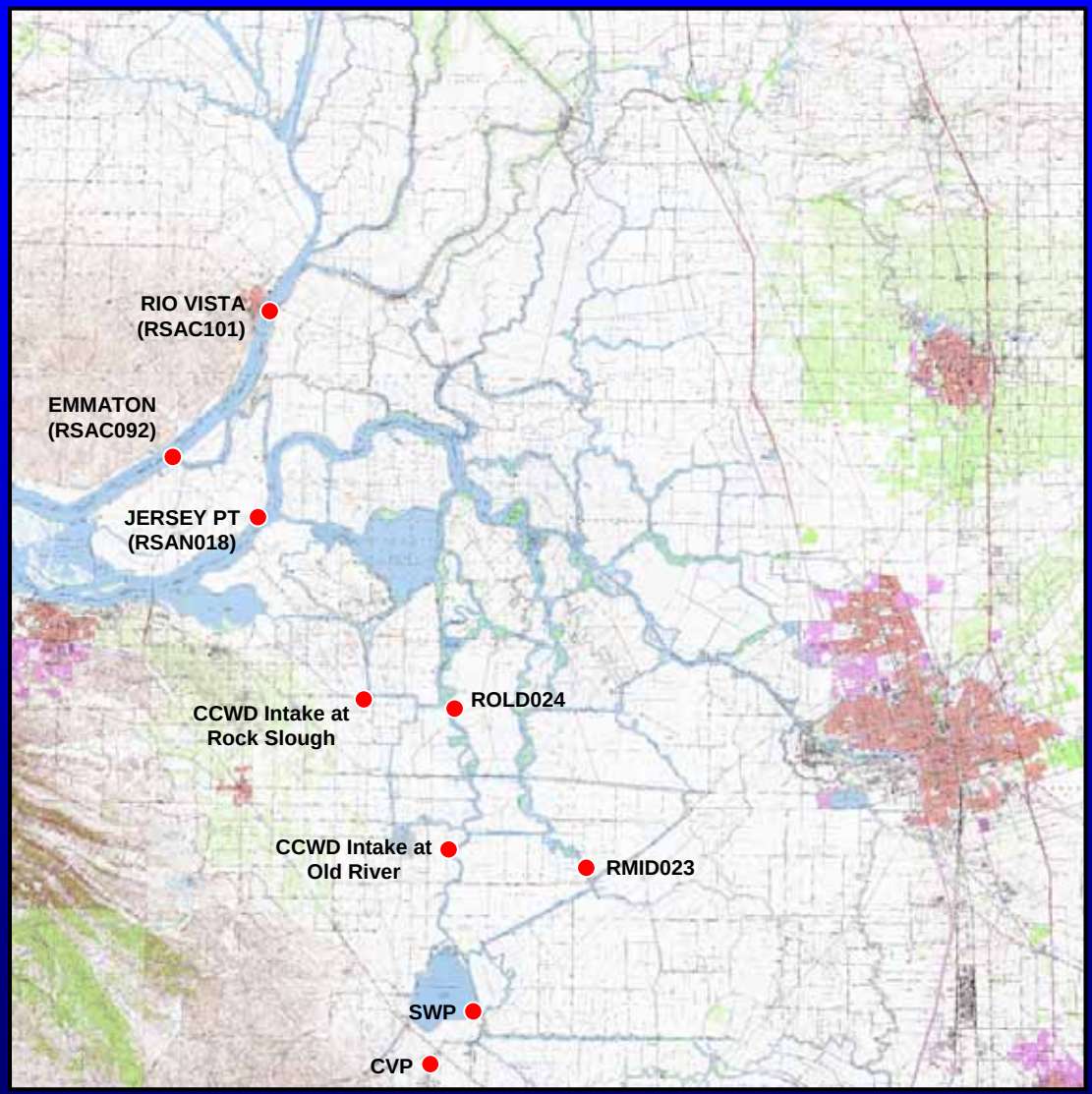
1991 Monthly Average Flow, DCC + Geogianna Sl + TDF



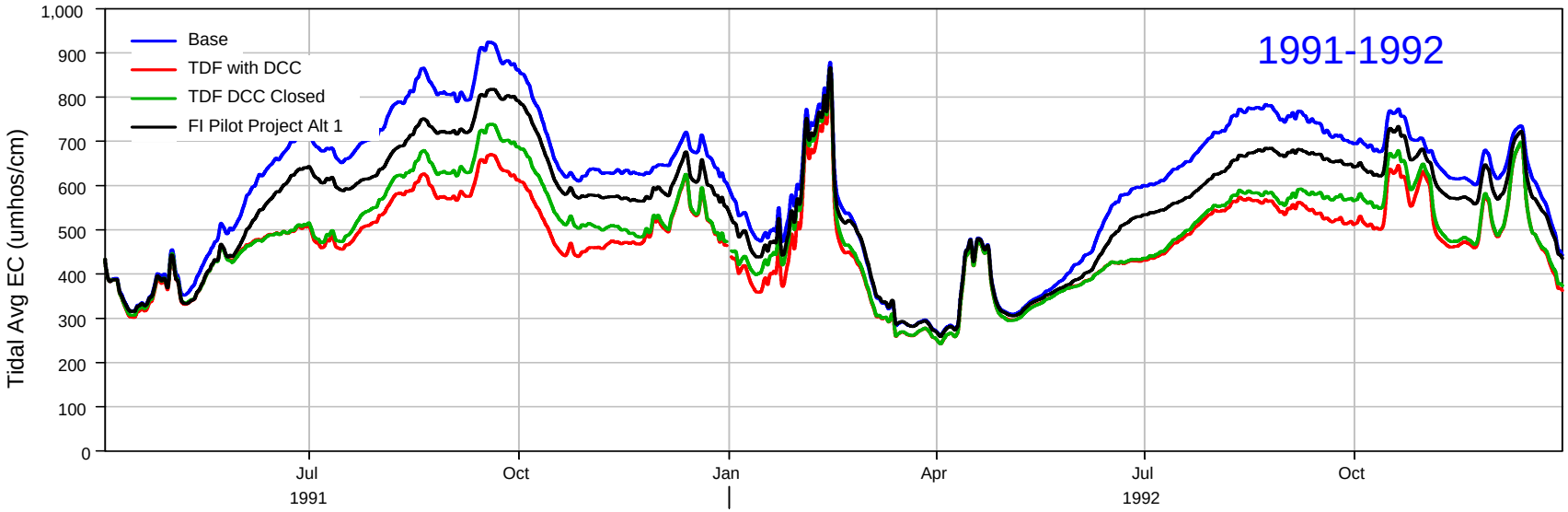
Delta EC Time Series Plots

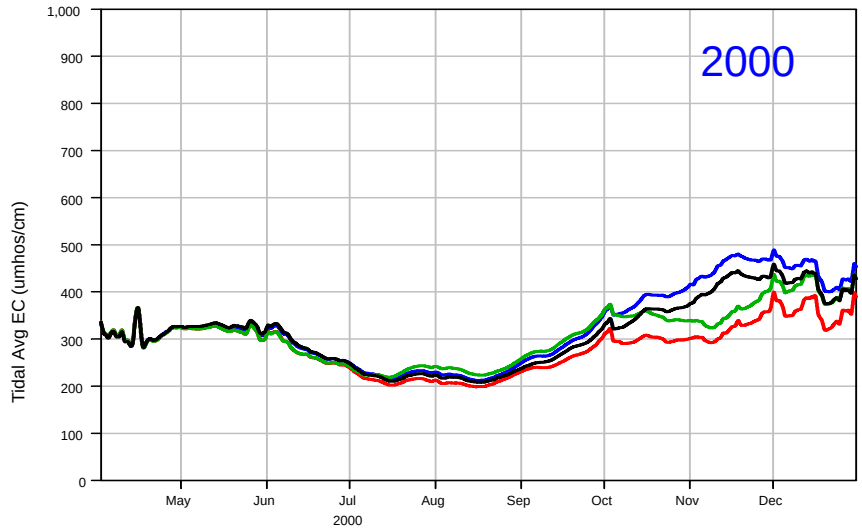
- The TDF with DCC provided more than twice the salinity reduction at the export locations vs. the Flooded Island Pilot Project Alternative 1
- Good salinity reduction at export locations with both TDF alternatives for dry months and critically dry years.
- For Critical Years, the TDF raises EC at Emmaton and Rio Vista. Need to add salinity control for TDF transfer and/or DCC.
- The FIPP Alternative 1 provided additional salinity reduction to the TDF (Simulated 2002 only).

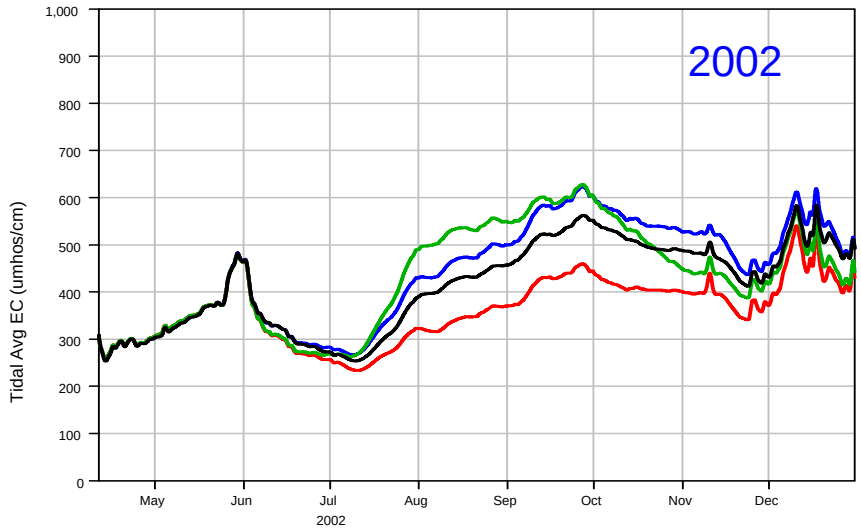
Delta EC Time Series Locations



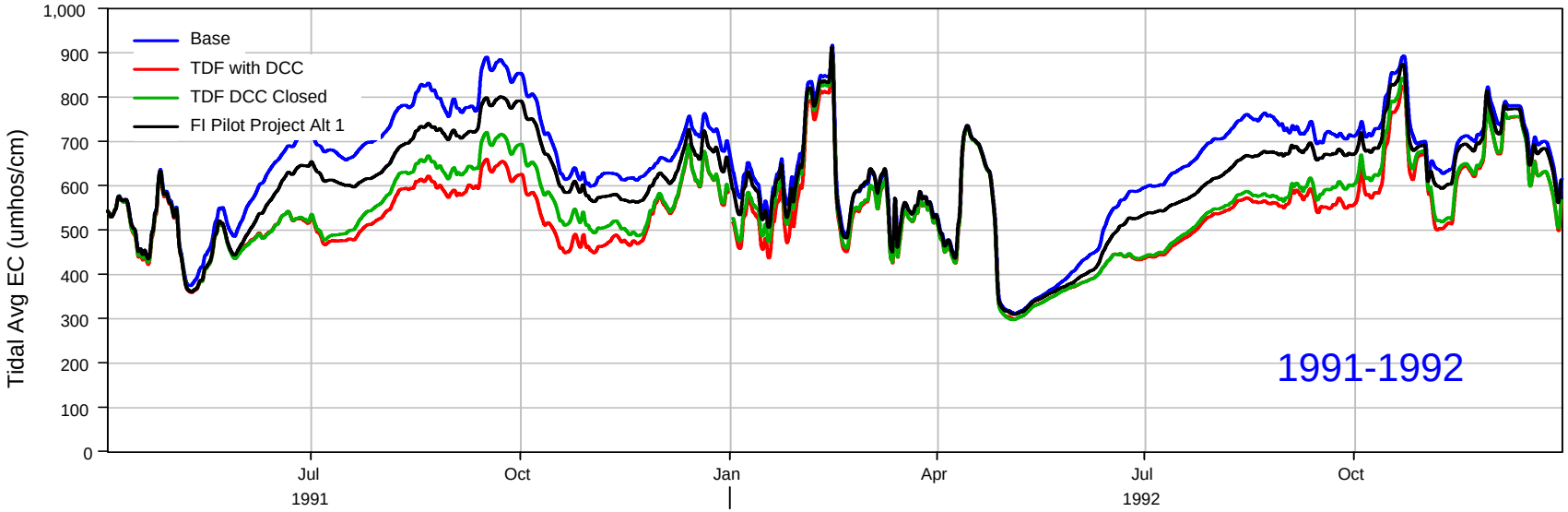
SWP

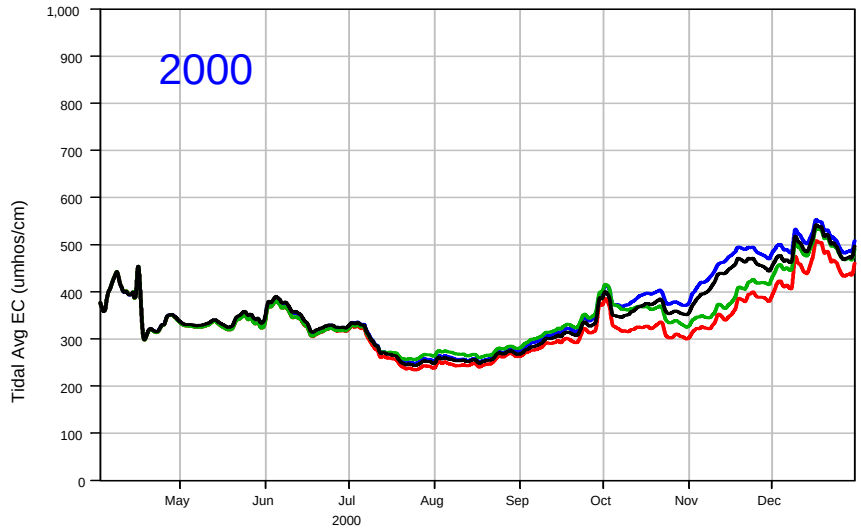

1,000
900
800
700
600
500
400
300
200
100
0
Tidal Avg EC (umhos/cm)
Base
TDF with DCC
TDF DCC Closed
FI Pilot Project Alt 1
1991-1992
Jul
1991
Oct
Jan
Apr
Jul
1992
Oct

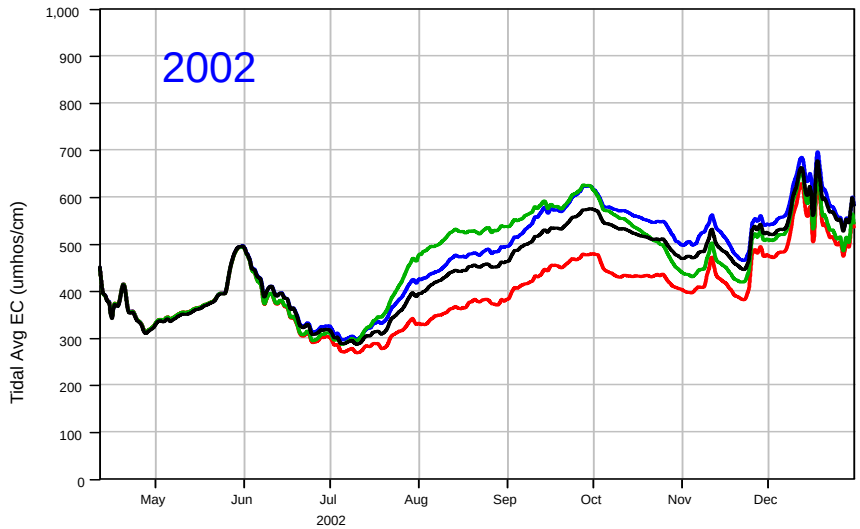

1,000
900
800
700
600
500
400
300
200
100
0
Tidal Avg EC (umhos/cm)
2000
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2000


1,000
900
800
700
600
500
400
300
200
100
0
Tidal Avg EC (umhos/cm)
2002
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2002

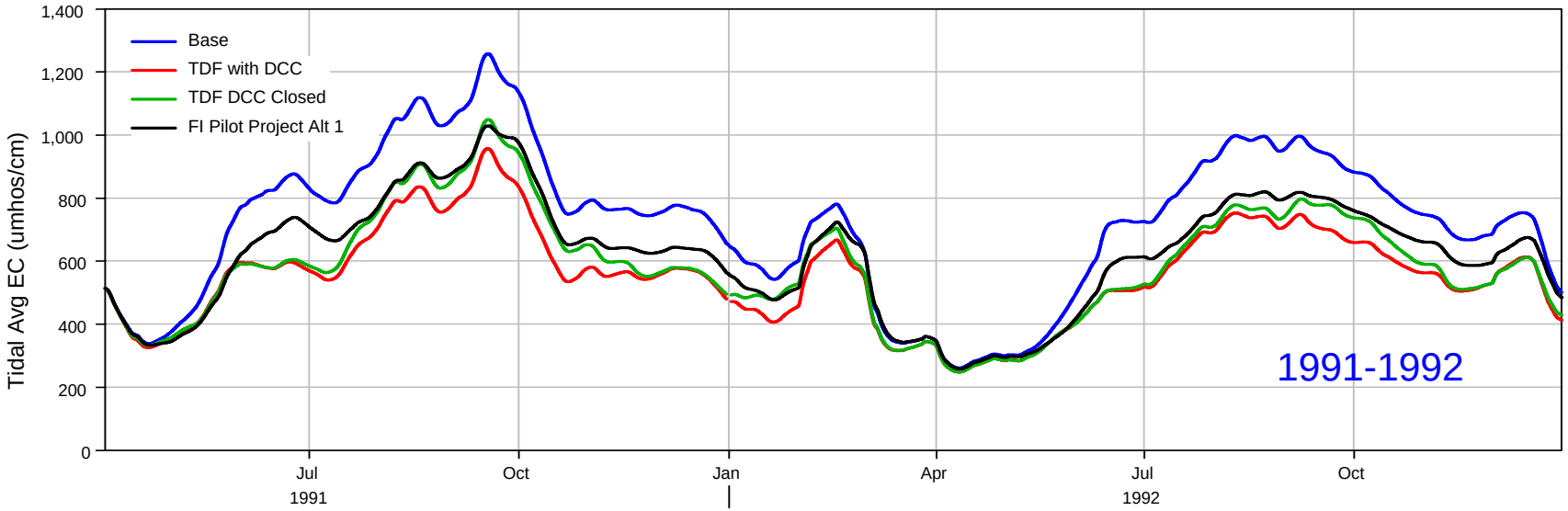
CVP

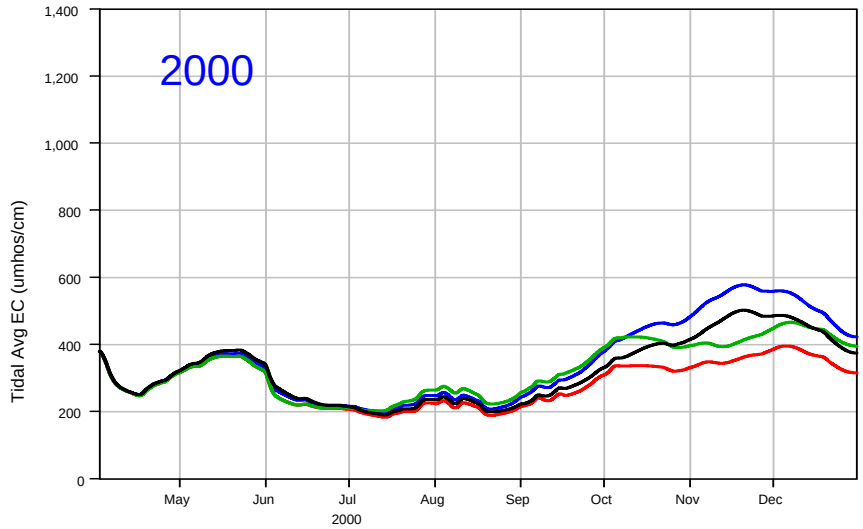

Base
TDF with DCC
TDF DCC Closed
FI Pilot Project Alt 1
Tidal Avg EC (umhos/cm)
1,000
900
800
700
600
500
400
300
200
100
0
Jul
1991
Oct
Jan
Apr
Jul
1992
Oct
1991-1992

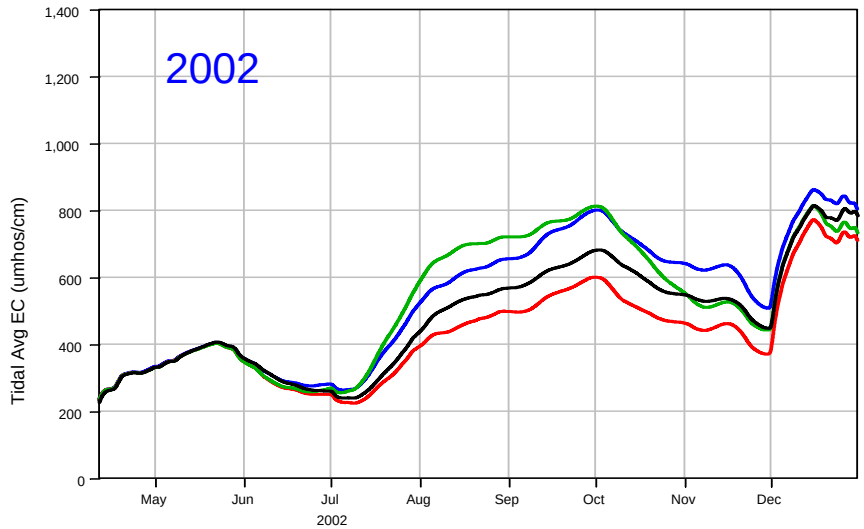

2000
Tidal Avg EC (umhos/cm)
1,000
900
800
700
600
500
400
300
200
100
0
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2000


2002
Tidal Avg EC (umhos/cm)
1,000
900
800
700
600
500
400
300
200
100
0
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2002

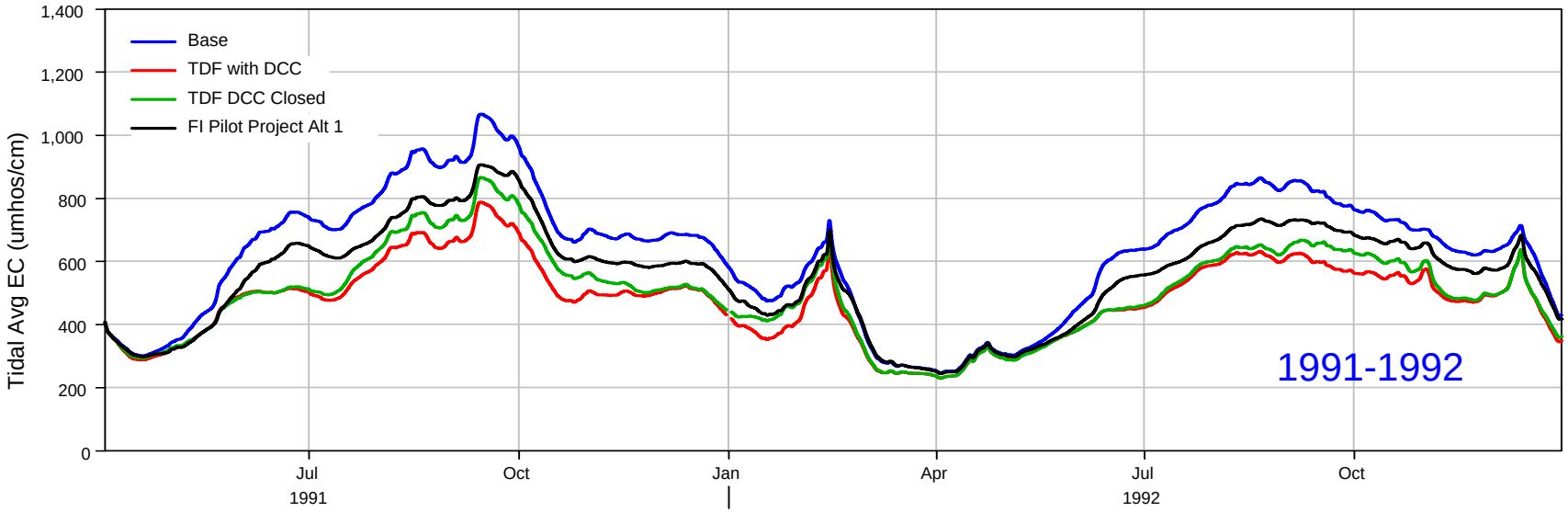
Contra Costa Intake at Rock Slough

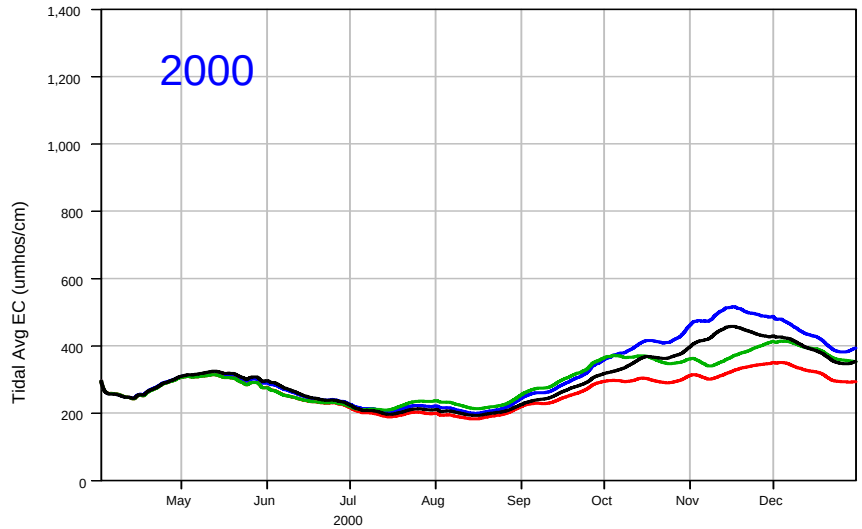


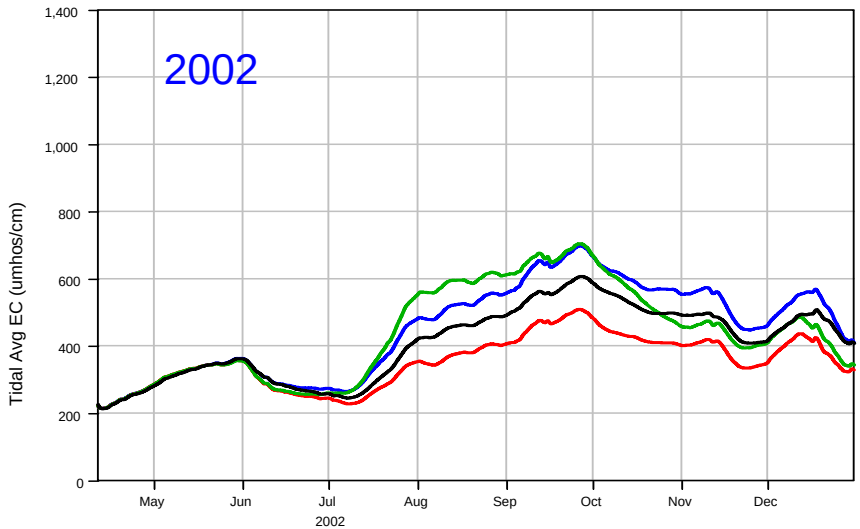




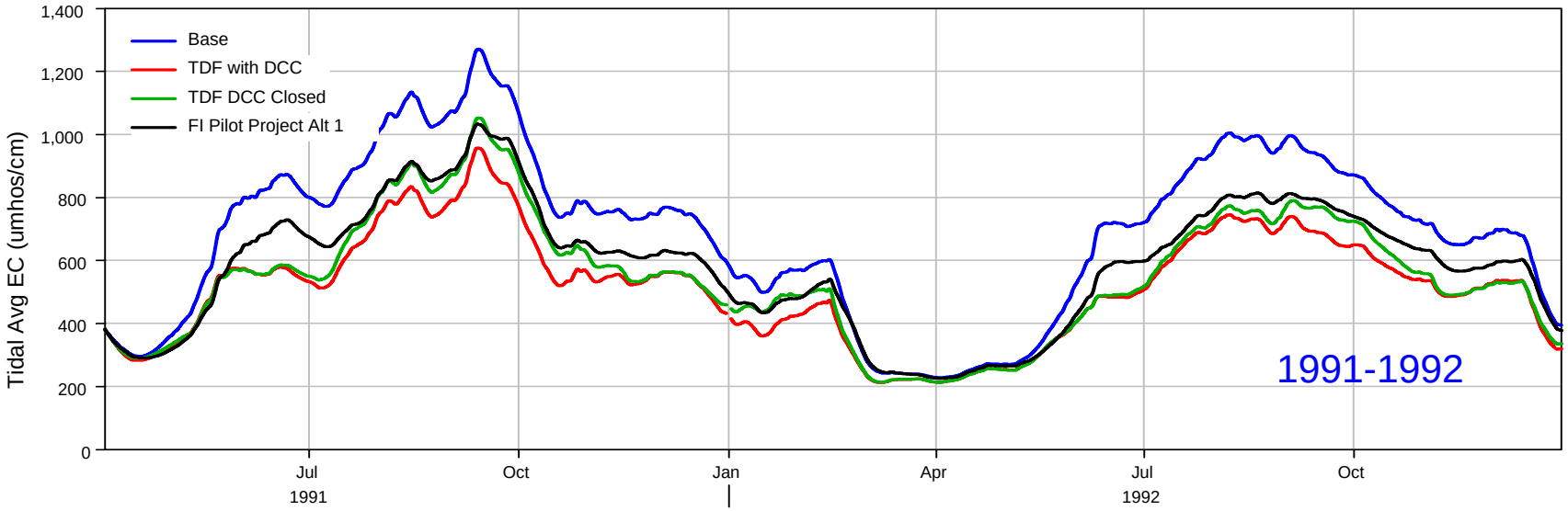
Contra Costa Intake at Old River

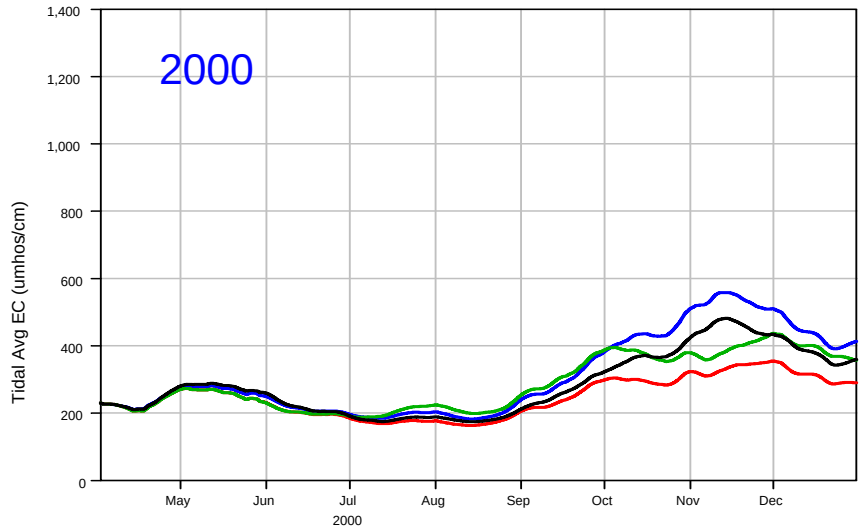


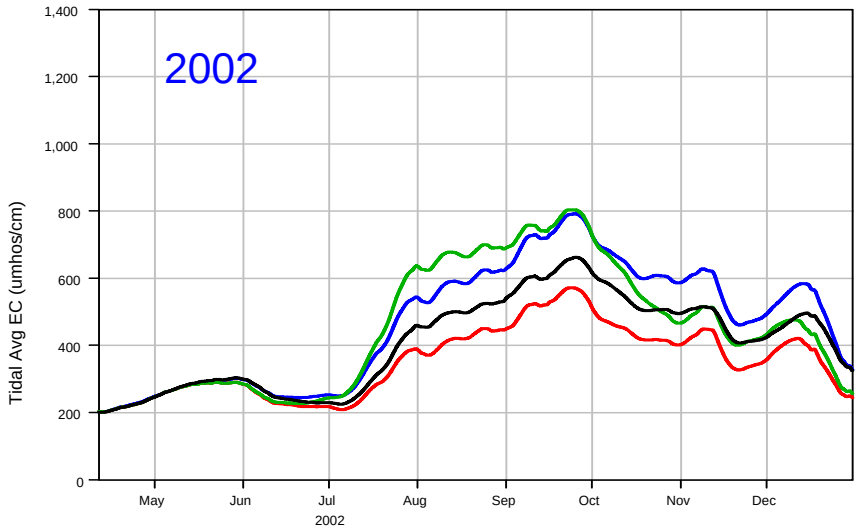




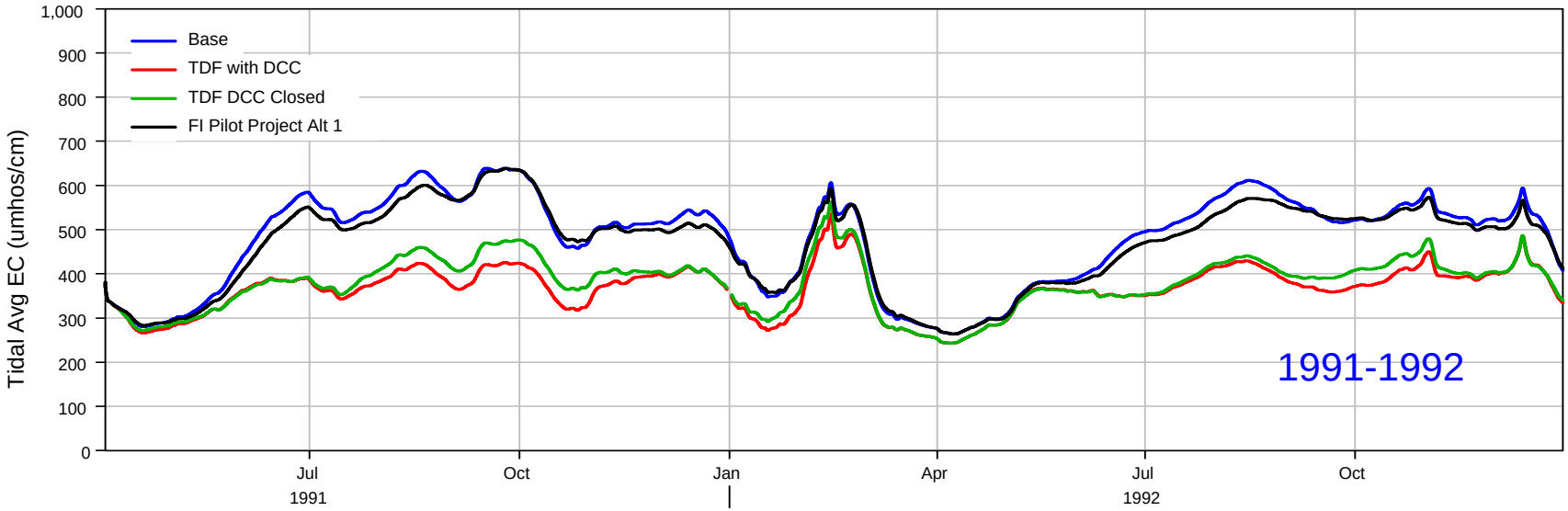
ROLD024

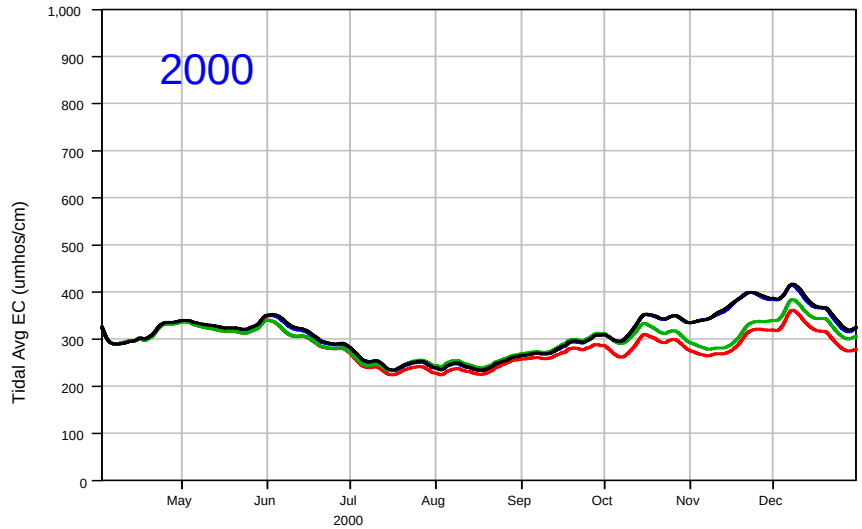

Base
TDF with DCC
TDF DCC Closed
FI Pilot Project Alt 1
Tidal Avg EC (umhos/cm)
1,400
1,200
1,000
800
600
400
200
0
Jul
1991
Oct
Jan
Apr
Jul
1992
Oct
1991-1992

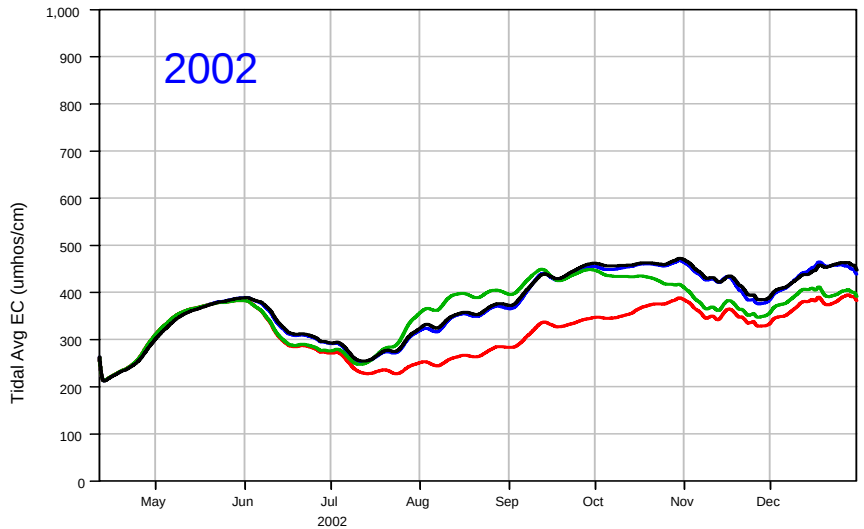

2000
Tidal Avg EC (umhos/cm)
1,400
1,200
1,000
800
600
400
200
0
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2000


2002
Tidal Avg EC (umhos/cm)
1,400
1,200
1,000
800
600
400
200
0
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2002

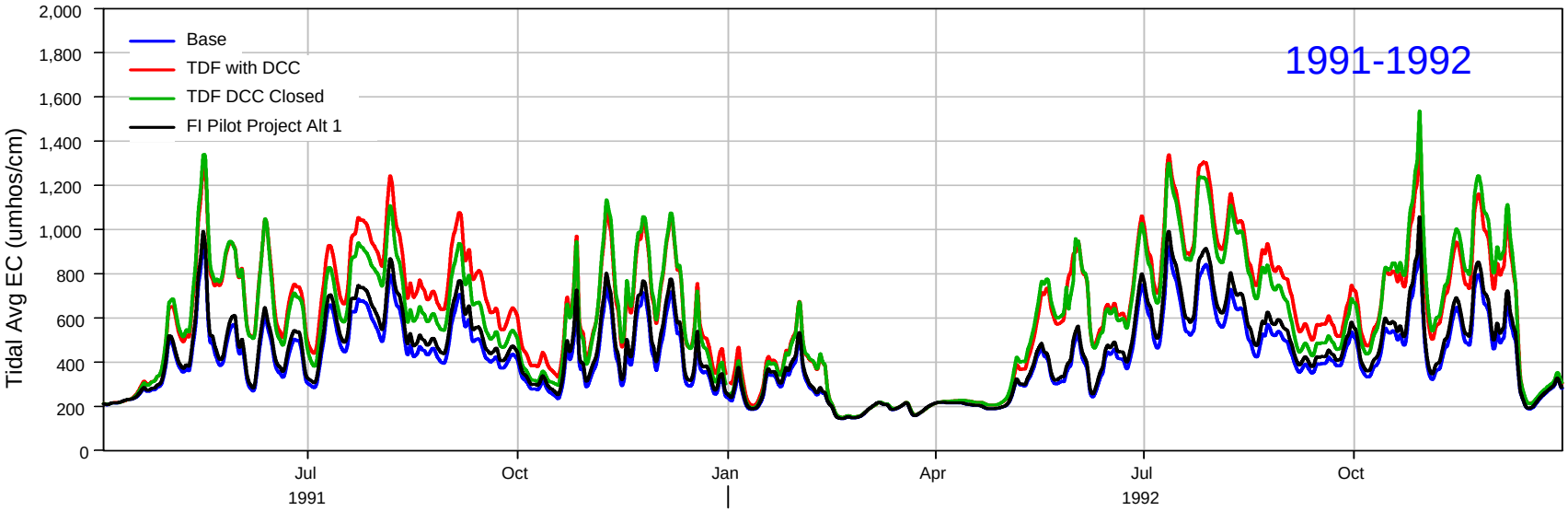
RMID023

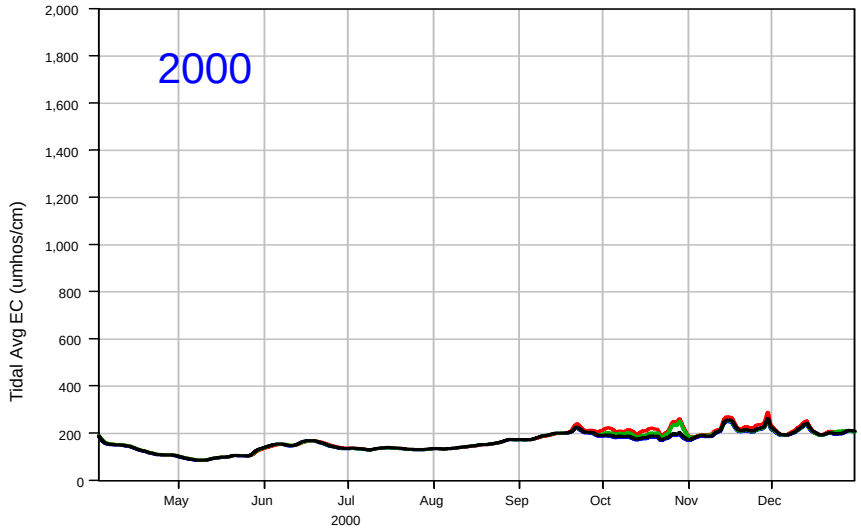

Base
TDF with DCC
TDF DCC Closed
FI Pilot Project Alt 1
Tidal Avg EC (umhos/cm)
1,000
900
800
700
600
500
400
300
200
100
0
Jul
1991
Oct
Jan
Apr
Jul
1992
Oct
1991-1992

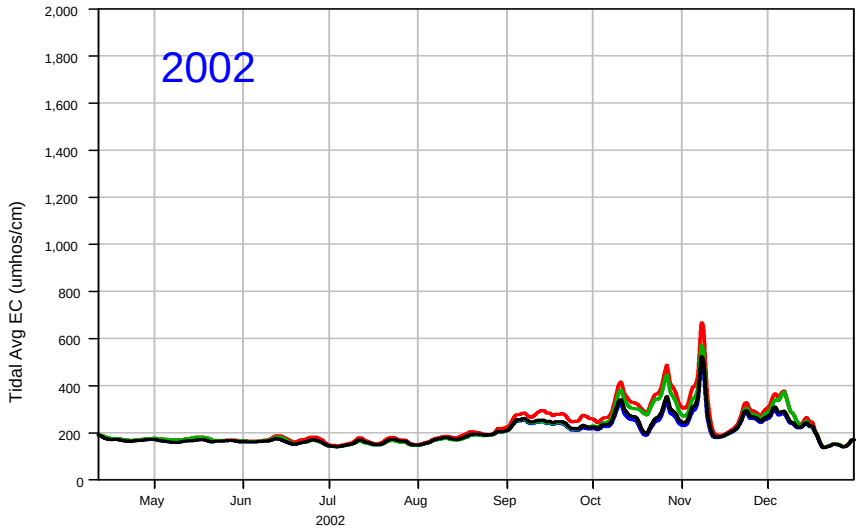

2000
Tidal Avg EC (umhos/cm)
1,000
900
800
700
600
500
400
300
200
100
0
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2000


2002
Tidal Avg EC (umhos/cm)
1,000
900
800
700
600
500
400
300
200
100
0
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2002

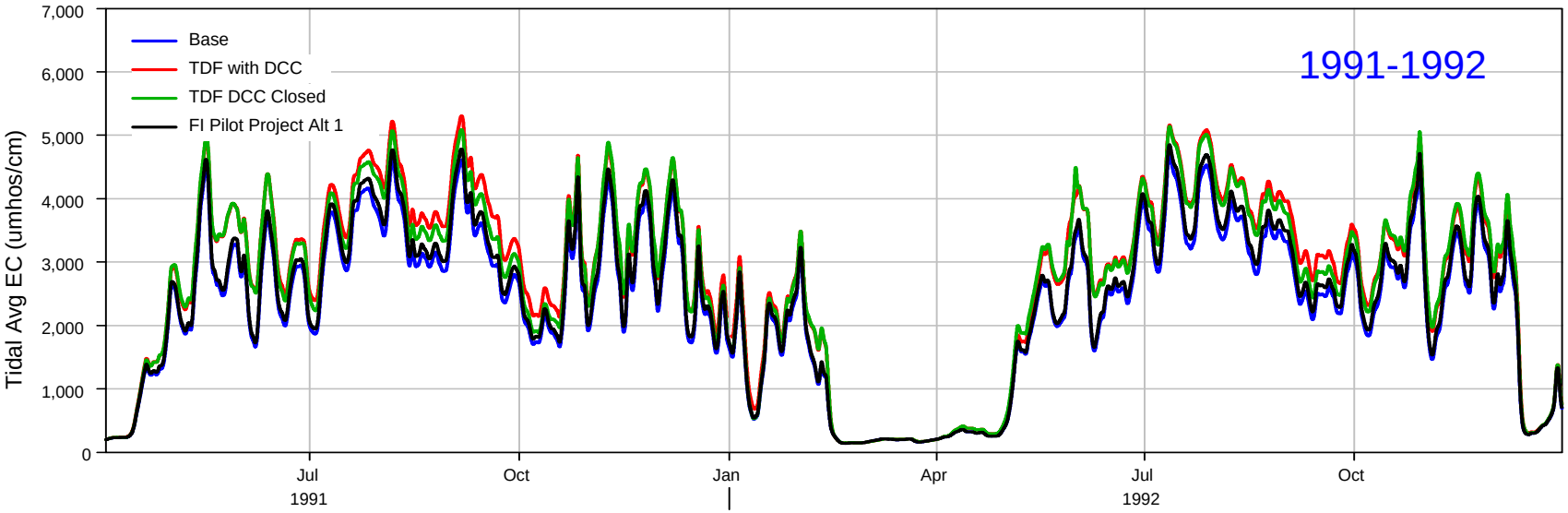
RSAC101 – Rio Vista

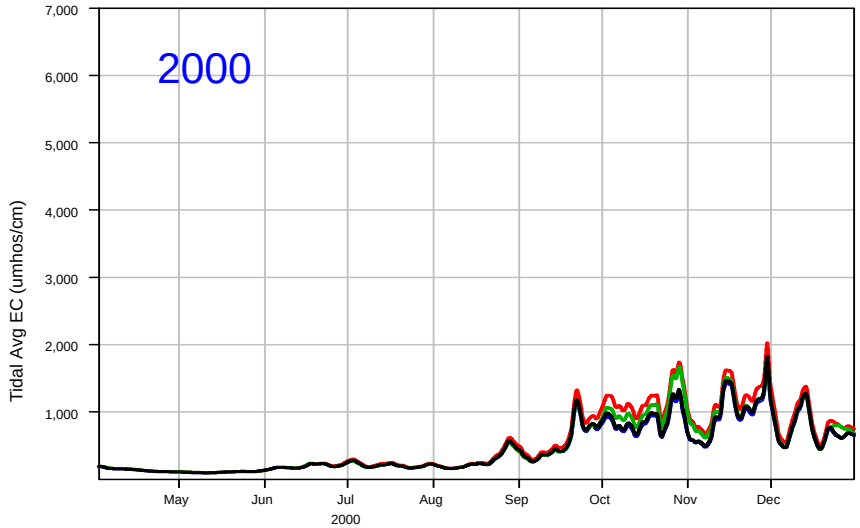


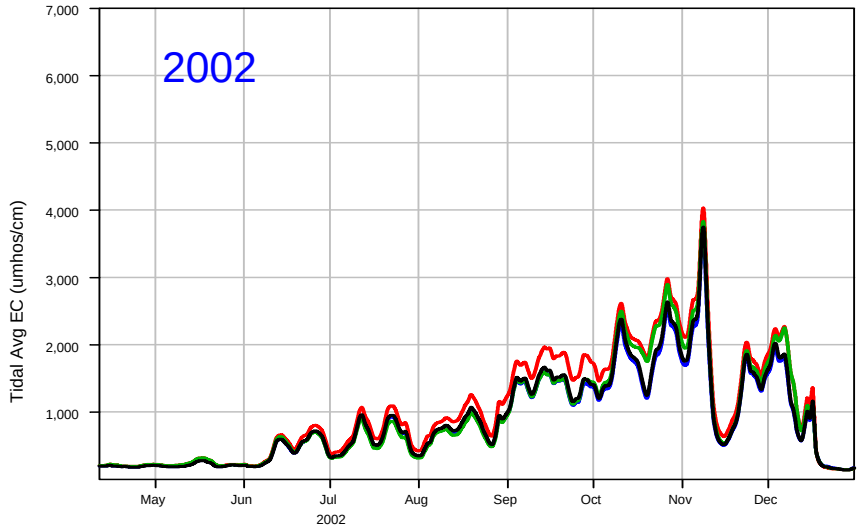




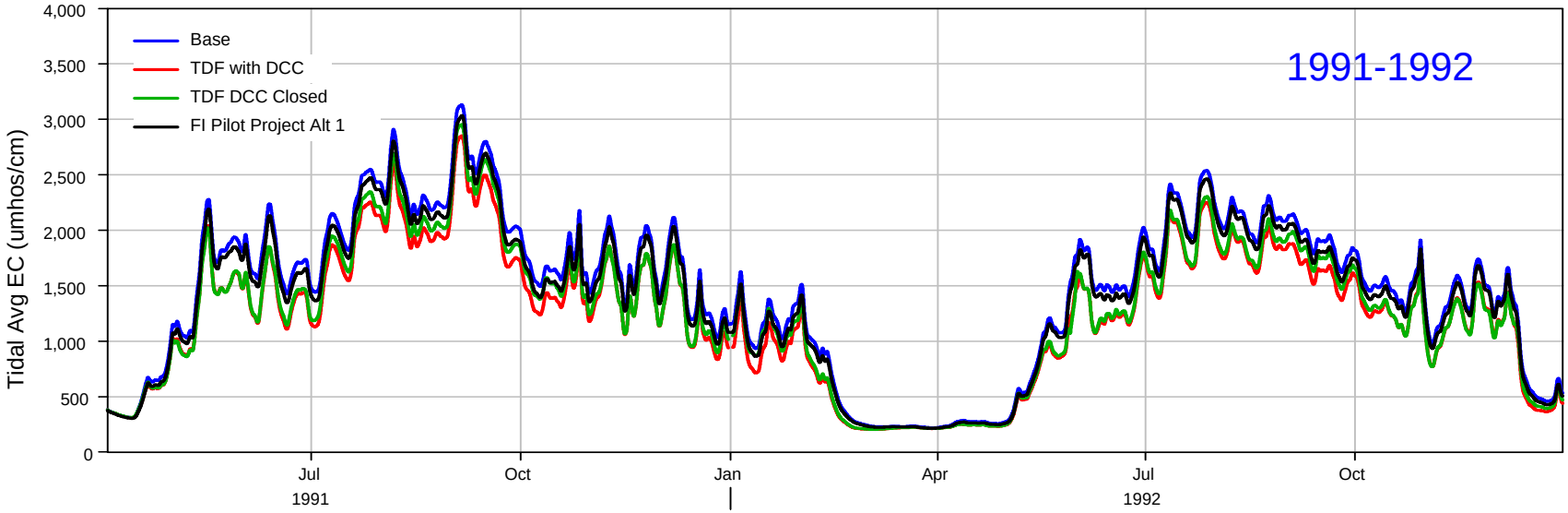
RSAC092 - Emmaton

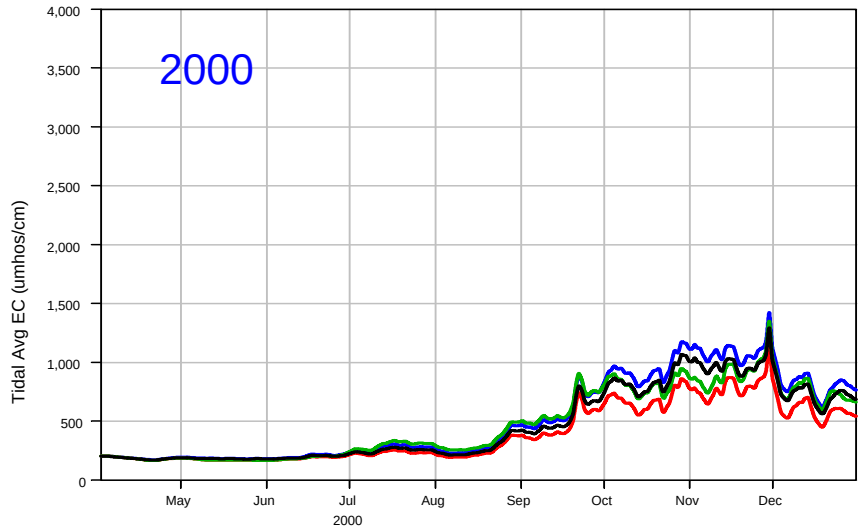


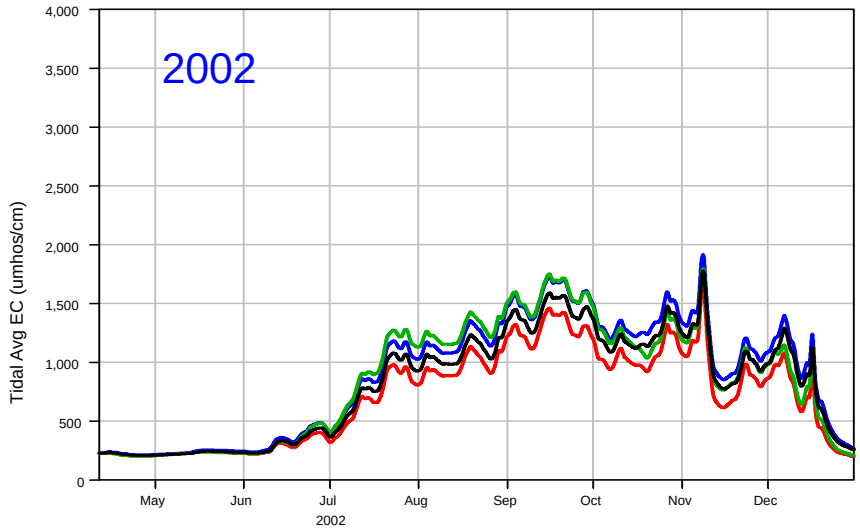




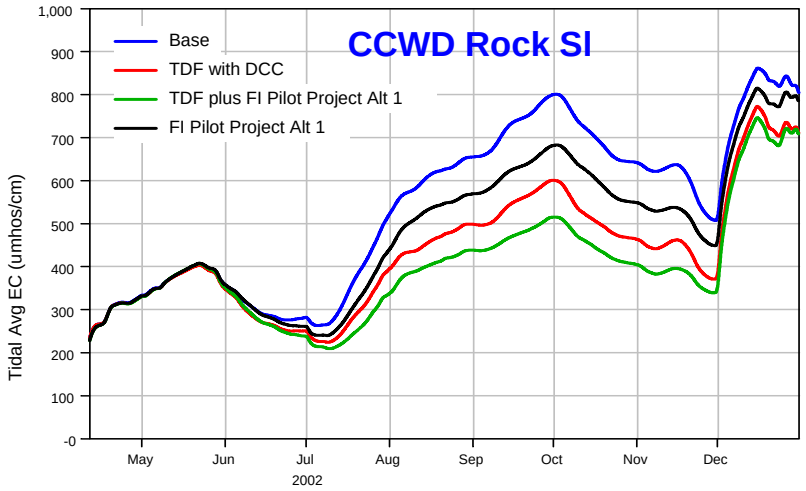
RSAN018 – Jersey Point

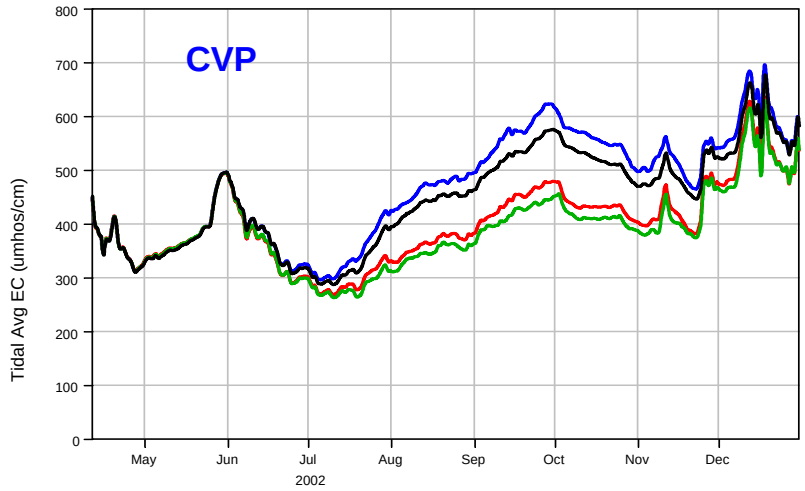


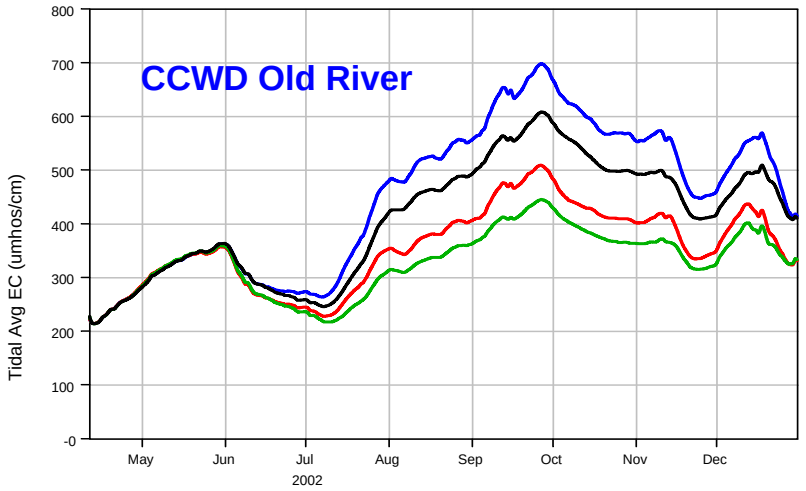


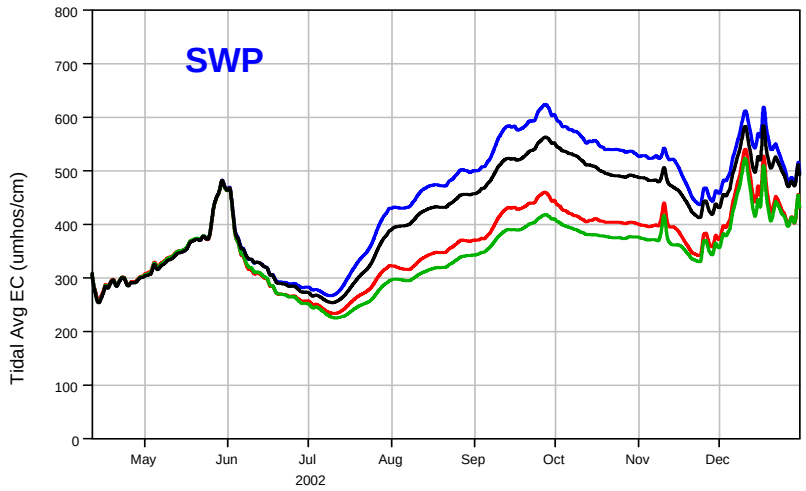


Combined TDF with FIPP Alternative 1, Year 2002









New TDF Modeling

- Develop Salinity Control operation of TDF
  - Add salinity control operation to code (in progress)
  - Examine EC change at Emmaton with different TDF Flows (1000 cfs, 2000 cfs, etc.)
  - DICU estimate for 1991 and 1992 affects Emmaton EC
- Consecutive 5 year simulations
  - 5 years “worst” case, 5 years best case.
  - Have performed 16 years for Base Condition runs
- TDF Operation
  - When would TDF not be operated?
- DCC Re-operation
  - Closed seasonally for fish migration?
  - Tidal operation, Day/Night operation

Particle Tracking for Regional Fish Study

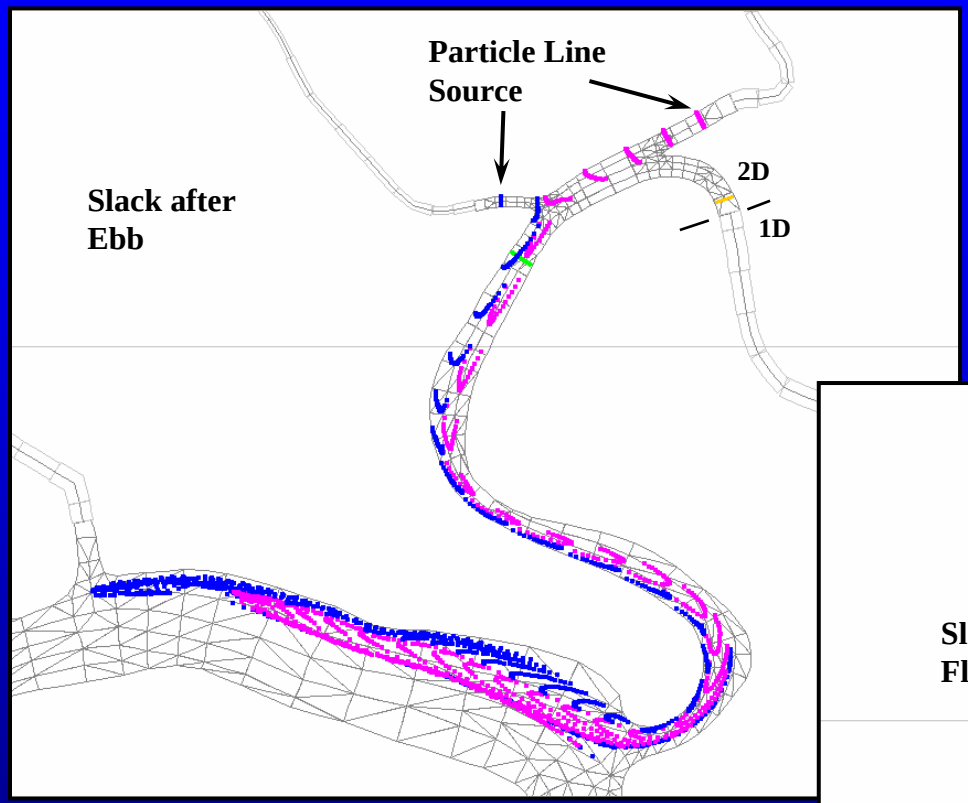
- Updated an existing particle tracking model (J.F. DeGeorge) for use with the RMA Delta model.
- New version of the model tracks particles smoothly through 1D/2D transitions and 1D junction elements.
- A particle tracking interface allows the user to interactively place particle source locations.
- Interface provides control over the number and timing of particles release, and particle transport properties.
- Visualization tool for animation of the computed particle tracking.

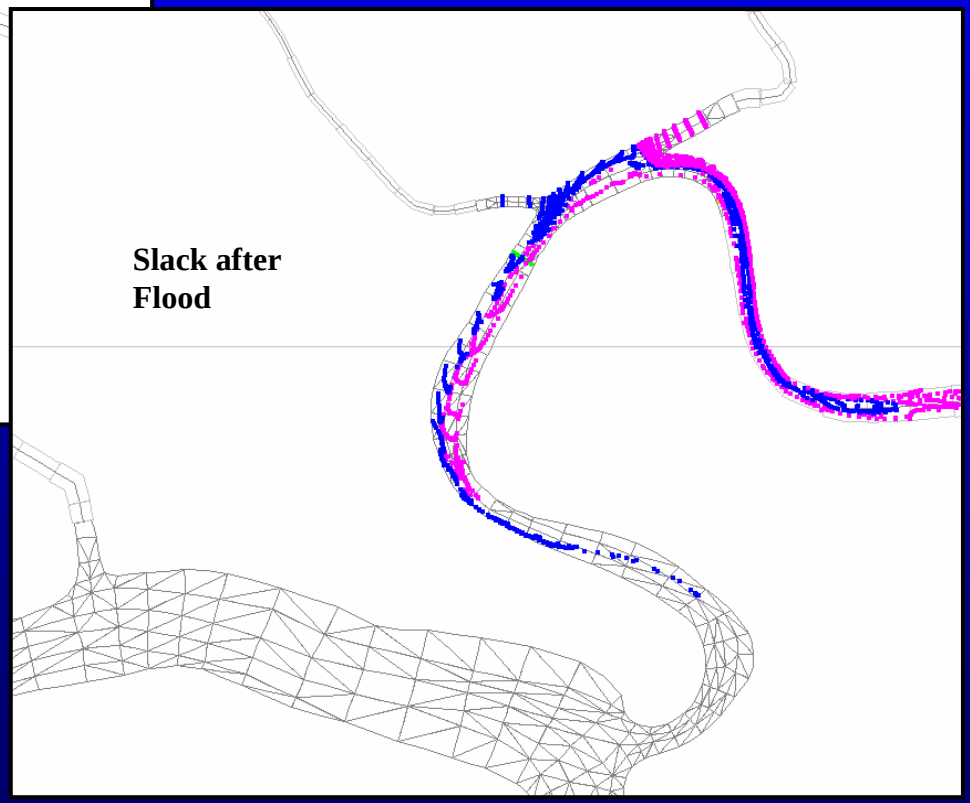
Particle Tracking Examples

- Example 1: Mixing of water from Georgianna Slough and the North Fork of the Mokelumne
  - Particles released from line sources every 15 minutes.
  - Particles disappear after 24 hours, showing distribution over a day.
  - Particles colored by source.
  - Transition between 2D and 1D sections of the network
- Example 2: San Joaquin River near Mokelumne River
  - Particle colors varied by location across channel.

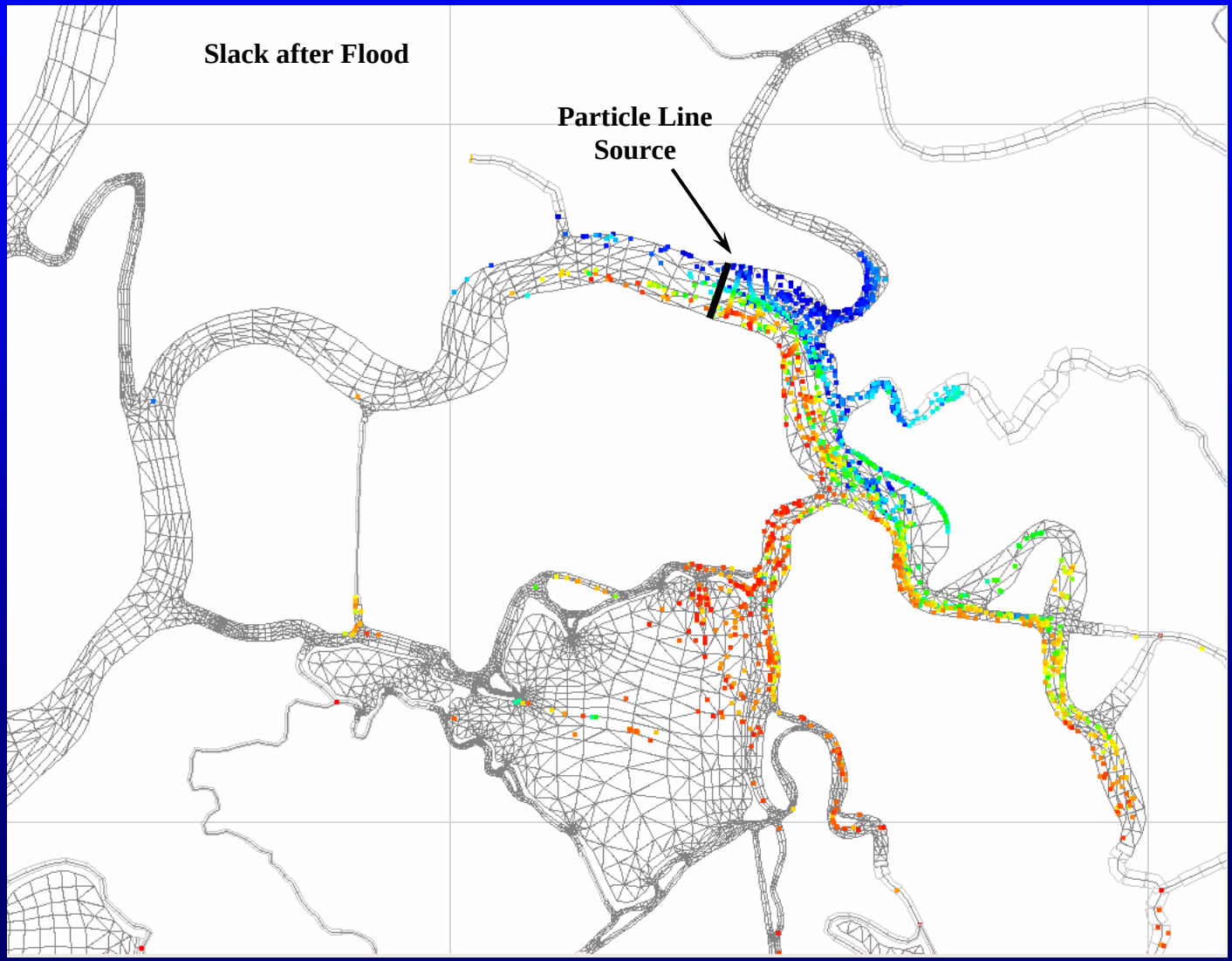
Particle Tracking:

Georgianna Sl and NF Mokelume





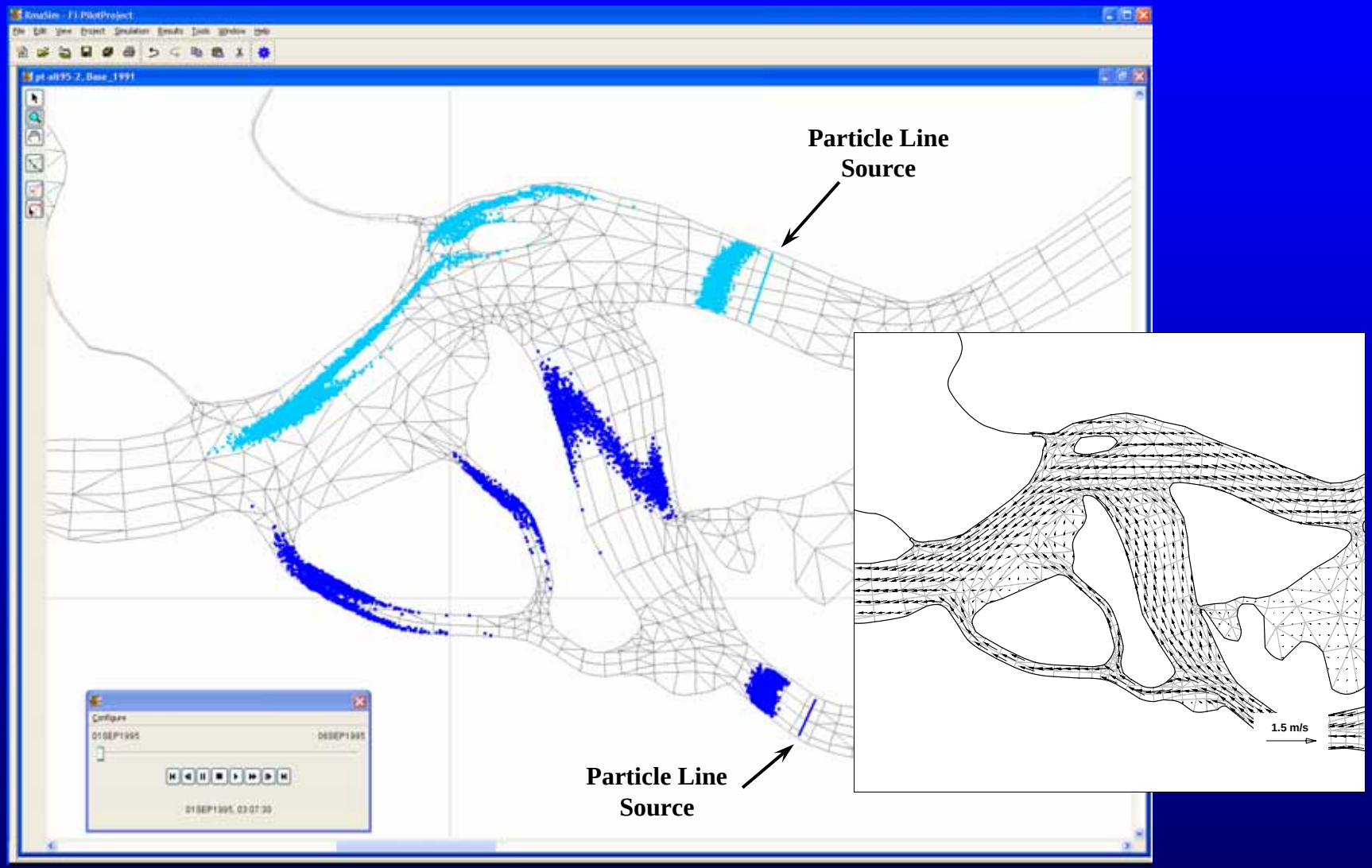
Particle Tracking:
San Joaquin River near Mokelumne River



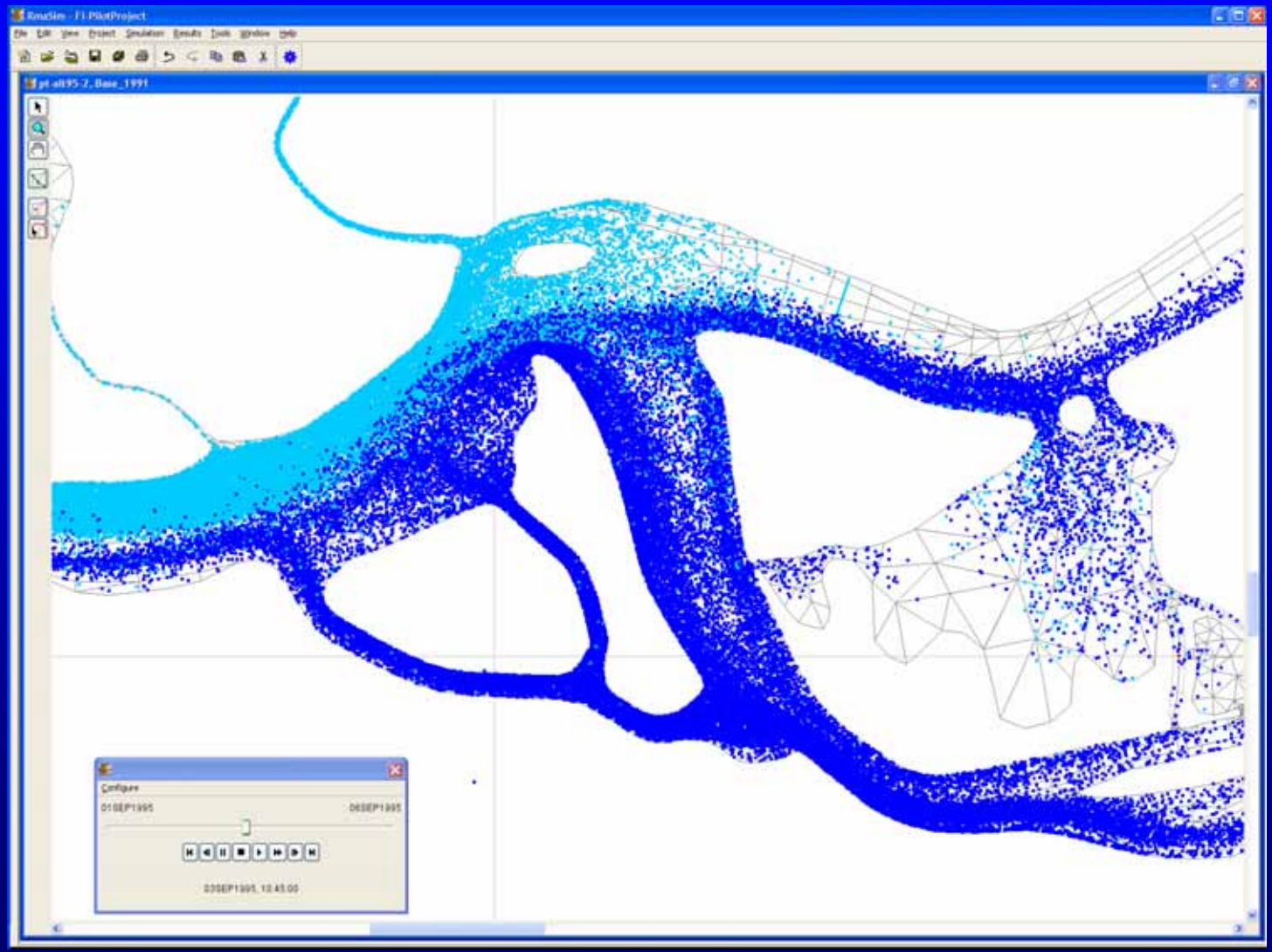
Particle Tracking Examples

- Example 3: Confluence of the Sacramento River and the San Joaquin River.
  - Up to 200,000 particles.
  - Particles have dispersion properties.
  - Release occurs every hour
  - Particles stop moving after 24.75 hours, showing spread after one tidal day.
  - Some particles “lost”

Particle Tracking: Confluence of the Sacramento River and San Joaquin River



Particle Tracking: Confluence of the Sacramento River and San Joaquin River



Particle Tracking: Confluence of the Sacramento River and San Joaquin River